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QUEEN CHARLOTTE ISLANDS COASTAL ZONE: DIGITAL MAPPING AND LINKED DATA BASE SYSTEM

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TABLE OF CONTENTS

	Page
SUMMARY	1
RESUME	4
INTRODUCTION	7
STUDY PURPOSE	7
STUDY PRODUCTS AND APPLICATIONS	9
Mainframe System	10
Microcomputer System	11
Example	?
Applications	11
SENSITIVE INFORMATION	14
DATA GAPS	14
STATEMENT FROM THE COUNCIL OF THE HAIDA NATION	15
METHODS	16
DIGITIZATION OF BASE MAPS	18
DEVELOPMENT OF DATA SHEETS	18
DATA COLLECTION	19
DATA TRANSCRIPTION	20
DATA REVIEW	21
DATA COLLECTION AND DATA OVERVIEW	22
COASTAL GEOMORPHOLOGY AND PROCESSES	24
Data Collection	24
Data Overview	29
Regional Overviews of Coastal Geomorphology and Processes	37
PLANTS	40
Data Collection	40
Data Overview	40
Regional Overviews of Plants	42
INVERTEBRATES	43
Data Collection	43
Data Overview	44
Regional Overviews of Invertebrates	46
FISH	48
Data Collection	48
Data Overview	49
Regional Overviews of Fish	51

TABLE OF CONTENTS (Continued)

	Page
BIRDS AND MAMMALS	54
Data Collection	54
Data Overview	55
Regional Overviews of Birds and Mammals	59
ARCHAEOLOGICAL SITES	61
Data Collection	61
Data Overview	62
Regional Overviews of Archaeological Sites	63
SITES OF HISTORICAL AND CULTURAL SIGNIFICANCE	64
Data Collection	64
Data Overview	64
Regional Overviews of Sites of Historical and Cultural Significance	65
SITES OF AESTHETIC, SCIENTIFIC AND RECREATIONAL SIGNIFICANCE	67
Data Collection	67
Data Overview	67
Regional Overviews of Sites of Aesthetic, Scientific and Recreational Significance	68
SOCIOPOLITICAL FEATURES AND COASTAL FACILITIES	70
Data Collection	70
Data Overview	70
Regional Overviews of Sociopolitical Features and Coastal Facilities	71
COMMERCIAL RESOURCE HARVESTING	72
Data Collection	72
Data Overview	73
Regional Overviews of Commercial Resource Harvesting	74
NON-COMMERCIAL RESOURCE HARVESTING	78
Data Collection	78
Data Overview	79
Regional Overviews of Non-Commercial Resource Harvesting	82
REFERENCES	84
APPENDICES	93
APPENDIX A: OBTAINING INFORMATION AND STUDY PRODUCTS	94
APPENDIX B: FIVE TYPES OF DATA SHEETS	97
APPENDIX C: SCIENTIFIC NAMES	111

LIST OF FIGURES

		Page
FIGURE 1.	Location map of the Queen Charlotte Islands	8
FIGURE 2a.	Example of 1:50,000 Map and Overlays	12
FIGURE 2b.	Coastal Contours and 20 m Bathymetric Contour (in pocket)	
FIGURE 2c.	Coastal Geomorphology (in pocket)	
FIGURE 2d.	Wave Exposure (in pocket)	
FIGURE 2e.	Fish (in pocket)	
FIGURE 2f.	Birds and Mammals (in pocket)	
FIGURE 3.	Study Work Plan	17
FIGURE 4.	NTS Map Sheets in Major Regions of Study Area	23
FIGURE 5.	Vertical Aerial Photography Coverage of the Coastal Zone, Queen Charlotte Islands	25
FIGURE 6.	Oblique Aerial Photography of the Coastal Zone, Queen Charlotte Islands	26
FIGURE 7.	Oblique Aerial Videotape Coverage of the Coastal Zone, Queen Charlotte Islands	27
FIGURE 8.	DFO Statistical Areas, Queen Charlotte Islands	50

LIST OF TABLES

		Page
TABLE 1.	Coastal Types of the Queen Charlotte Islands and Frequency of Occurrence	30
TABLE 2.	Distribution of Coastal Types in Different Geographic Regions	32
TABLE 3.	Tidal Range of Coastal Segments on the Queen Charlotte Islands	34
TABLE 4.	Wave Exposure Levels of Coastal Segments of the Queen Charlotte Islands	36
TABLE 5.	Surveys of Coastal Zone Kelps in the Queen Charlotte Islands	41
TABLE 6.	Regional Summary of Invertebrate Surveys in the Queen Charolotte Islands	45
TABLE 7.	Estimated Numbers of Breeding Pairs of Seabirds in the Queen Charlotte Islands	57
TABLE 8.	Average Landings (Metric Tonnes) of Selected Finfish and Shellfish Species in D.F.O. Statistical Areas 1, 2E and 2W, 1981 - 1985	75
TABLE 9.	Food Types Harvested Non-Commercially in the Queen Charlotte Islands	81

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Valuable information was provided to the study by residents of the Queen Charlotte Islands who participated in the interview program. Various municipal, provincial and federal agencies and private companies also made unpublished information available to the study.

SUMMARY

The possibility of future oil exploration in Dixon Entrance, Hecate Strait, and Queen Charlotte Sound is now under review. A decision to proceed with oil exploration in northern coastal British Columbia will require detailed information on resources for use in coastal zone planning and in preparing oil spill contingency plans (logistical plans outlining procedures for responding to oil spills). The Environmental Studies Research Funds (ESRF) recognized the need to establish a data base of existing information on coastal resources of the Queen Charlotte Islands, and decided to develop a digital mapping and linked data base system. This report describes the system that was developed. The computerized system allows display of the available information in a mapped format with associated descriptive information. The system facilitates updating and expansion of the data base as new information becomes available. The objective of this study was to develop a mapping/data system using existing data and only a limited amount of new data was collected. The digital mapping and linked data base system described in this report will be one component used in the contingency planning process.

The Queen Charlotte Islands coastal zone mapping study developed a 1:50,000 digital mapping and linked data base system for coastal resources of the islands for use in oil spill contingency planning. This computer-based, information management system contains data on coastal geomorphology and processes; biological resources; resource harvesting; areas of special cultural, historical, archaeological, aesthetic, recreational and scientific significance; and sociopolitical features and coastal facilities. Information in the data base was compiled between September 1984 and January 1986 from widespread existing sources including technical reports, aerial photographs and videotapes, maps, unpublished data, data archives, fisheries data, government departments, and museums. In addition, individuals from 110 households in the Queen Charlotte Islands were interviewed to collect data on non-commercial resource harvesting and areas of special significance.

The most important results of this study include: (i) acquisition of a large and potentially useful data base on non-commercial, coastal zone resource uses; (ii) development of a mainframe computer system for coastal zone resource mapping and data base; and (iii) development of a microcomputer version of the system. About 2,300 non-commercial resource use data records (representing unique combinations of species and locations) were collected through an interview program. The resulting data base could be extremely useful in many aspects of coastal zone management.

The mainframe version of the mapping and data base system is a major computer installation consisting of commercially available hardware and software. This version has powerful capabilities for digitizing, storing, retrieving, and displaying information as well as sophisticated capabilities to query and manipulate the data base. An important attribute of the mapping and data base system is that it can be readily updated or modified as additional information on coastal zone resources and resource uses becomes available. The microcomputer version of the system was developed as part of this study and includes software to download all of the information on the mainframe system to a microcomputer. It is menu-driven and well suited for desk-top use. At its present stage of development, the microcomputer version has a variety of display and printing functions and a password system to protect sensitive information in the data base.

Information gaps existing in the data base which affect its completeness for various purposes are the result of limited geographical coverage by various surveys or the lack of information on species or features of little commercial value. The significance of the data gaps for various purposes such as oil spill contingency planning can only be determined after the area potentially affected has been defined.

The digital maps and data base system on coastal zone resources of the Queen Charlotte Islands is intended specifically for oil spill contingency

planning, but it has many other potential applications in all aspects of coastal zone planning and management. The structure and the methods developed in this study for data collection, transcription, and review of the data base are directly applicable to other geographical areas and can be readily modified for specific resource management and planning requirements.

RESUMÉ

On examine actuellement la possibilité d'une exploration pétrolière dans les détroits de Dixon, d'Hécate et de la Reine-Charlotte. La décision relative à la mise en oeuvre de cette exploration dans le nord de la zone côtière de la Colombie-Britannique nécessitera des informations détaillées sur les ressources pour la planification de cette zone et la préparation de mesures d'urgence en cas de déversement de pétrole (plans logistiques décrivant les procédures dans ces cas-là). Les responsables des fonds de recherche pour l'étude de l'environnement ont reconnu la nécessité d'établir une base de données comprenant les informations existantes sur les ressources côtières des îles de la Reine-Charlotte, et ils ont décidé d'élaborer un système de cartographie numérique et de base de données reliées. Le présent rapport décrit l'ensemble mis au point. Ce système informatisé permet l'affichage des données disponibles en un format cartographique accompagné des données descriptives connexes, et il facilite également la mise à jour et l'extension de la base de données, au fur et à mesure que de nouvelles informations sont disponibles. L'objectif de l'étude étant de mettre au point un système de cartographie et de données utilisant les renseignements existants, un nombre limité de nouvelles informations ont été recueillies. Le système de cartographie numérique et de base de données reliées, décrit dans le présent rapport, constituera l'un des éléments utilisés dans la planification des mesures d'urgence.

Dans l'étude cartographique de la zone côtière des îles de la Reine-Charlotte, on a élaboré un système de base de données reliées et de cartographique numérique à l'échelle 1:50,000 pour les ressources côtières des îles et devant être utilisé pour la planification des mesures d'urgence en cas de déversement de pétrole. Ce système intégré de gestion, à base informatique, comprend des données relatives aux domaines suivants: géomorphologie côtière et processus; ressources biologiques; utilisation des ressources; sites présentant un intérêt particulier au point de vue culturel, historique, archéologique, esthétique, récréatif et scientifique; caractéristiques socio-politiques et installations côtières. Les informations de la base de données ont été rassemblées entre septembre 1984 et janvier 1986, à partir de sources

très différentes telles que des rapports techniques, des bandes vidéo et photographies aériennes, des cartes, des données inédites, des archives, des données sur les pêches, et des informations de ministères et de musées. En outre, on a interviewé des individus dans 110 ménages des îles de la Reine-Charlotte afin de rassembler des données sur l'utilisation non commerciale des ressources et sur les zones présentant un intérêt particulier.

Les résultats les plus importants de cette étude sont les suivants: i) l'acquisition d'une vaste base de données qui pourrait être utile en ce qui a trait à l'utilisation non commerciale des ressources de la zone côtière; ii) le développement d'un système d'unité centrale pour la base de données et la cartographie des ressources de la zone côtière; et iii) la mise au point d'une version du système à base de micro-ordinateur. Dans le cadre d'un programme d'entrevues, l'on a recueilli environ 2300 enregistrements de données sur l'utilisation non commerciale des ressources (représentant des combinaisons uniques d'espèces et d'emplacements). Cette base de données pourrait être extrêmement utile pour différents aspects de la gestion de la zone côtière.

La version à unité centrale du système de cartographie et de base de données est une installation importante comprenant un ensemble de matériel et de logiciel disponibles sur le marché. Cette version a d'énormes possibilités en matière de numérisation, de stockage, de recherche et d'affichage des informations; elle est aussi très perfectionnée en ce qui concerne l'interrogation et la manipulation de la base de données. Un des attributs importants de ce système de cartographie et de base de données est qu'il peut être facilement mis à jour ou modifié, à mesure que des informations additionnelles sont disponibles sur les ressources de la zone côtière et l'utilisation des ressources. La version à base de micro-ordinateur a été mise au point dans le cadre de la présente étude et comprend un logiciel permettant de transférer toutes les informations de l'unité centrale à un micro-ordinateur. Cette version est à base de menus et bien appropriée à une utilisation de bureau. Au stade actuel de développement, elle présente tout un éventail de fonctions d'affichage et d'impression et un système de mot de passe pour protéger les informations confidentielles dans la base de données.

Les trous existant dans la base de données, et qui l'empêchent d'être complète pour divers objectifs, sont le résultat d'une couverture géographique limitée dans différentes études ou d'un manque d'informations sur des espèces ou des caractéristiques de peu de valeur commerciale. L'importance des trous pour différents objectifs, tels que la planification de mesures d'urgence en cas de déversement de pétrole, ne peut être établie qu'après que la zone potentiellement affectée aura été déterminée.

Le système de cartes numériques et de base de données sur les ressources de la zone côtière des îles de la Reine-Charlotte est destiné particulièrement à la planification des mesures d'urgence en cas de déversement de pétrole, mais il a également beaucoup d'autres applications potentielles pour tout ce qui concerne la planification et la gestion des zones côtières. La structure et les méthodes, mises au point dans cette étude pour la collecte des données, les transcriptions ainsi que l'examen de la base de données, sont directement applicables à d'autres aires géographiques, et peuvent être facilement modifiées à des fins particulières de gestion et de planification de ressources.

INTRODUCTION

The coastal zone of the Queen Charlotte Islands is a physically dynamic, biologically productive and culturally rich area. The Charlottes (Figure 1) have provided a home for many Haida communities and most of the resources necessary to sustain their rich culture since prehistoric times. Today, Haida people continue to rely on the coastal zone as a dominant part of their cultural heritage and as the economic foundation of their communities. Other residents of the Charlottes also rely on the coastal zone for commercial and non-commercial harvesting of food as well as other uses including recreation, tourism, transportation, forestry and log-handling. Some areas within the coastal zone, such as archaeological sites, ecological reserves and provincial parks have special legal status. Numerous other areas have special historical or cultural significance or have been recommended for special status as ecological reserves or parks. Still other places, including many archaeological sites and areas of Haida non-commercial resource harvesting, have not yet been systematically surveyed or catalogued.

In this study, the coastal zone is defined as the area (including all islands) from about 500-m inshore of the high water-line to the 20-m bathymetric contour. This definition is flexible and recognizes many important exceptions to these boundaries including estuaries, inlet systems, and river mouths.

STUDY PURPOSE

The purpose of this study was to use existing information and information obtained from interviews in the Charlottes to produce a 1:50,000 digital mapping and linked data base system for coastal resources of the Queen Charlotte Islands. No evaluation of data quality for various purposes was undertaken.

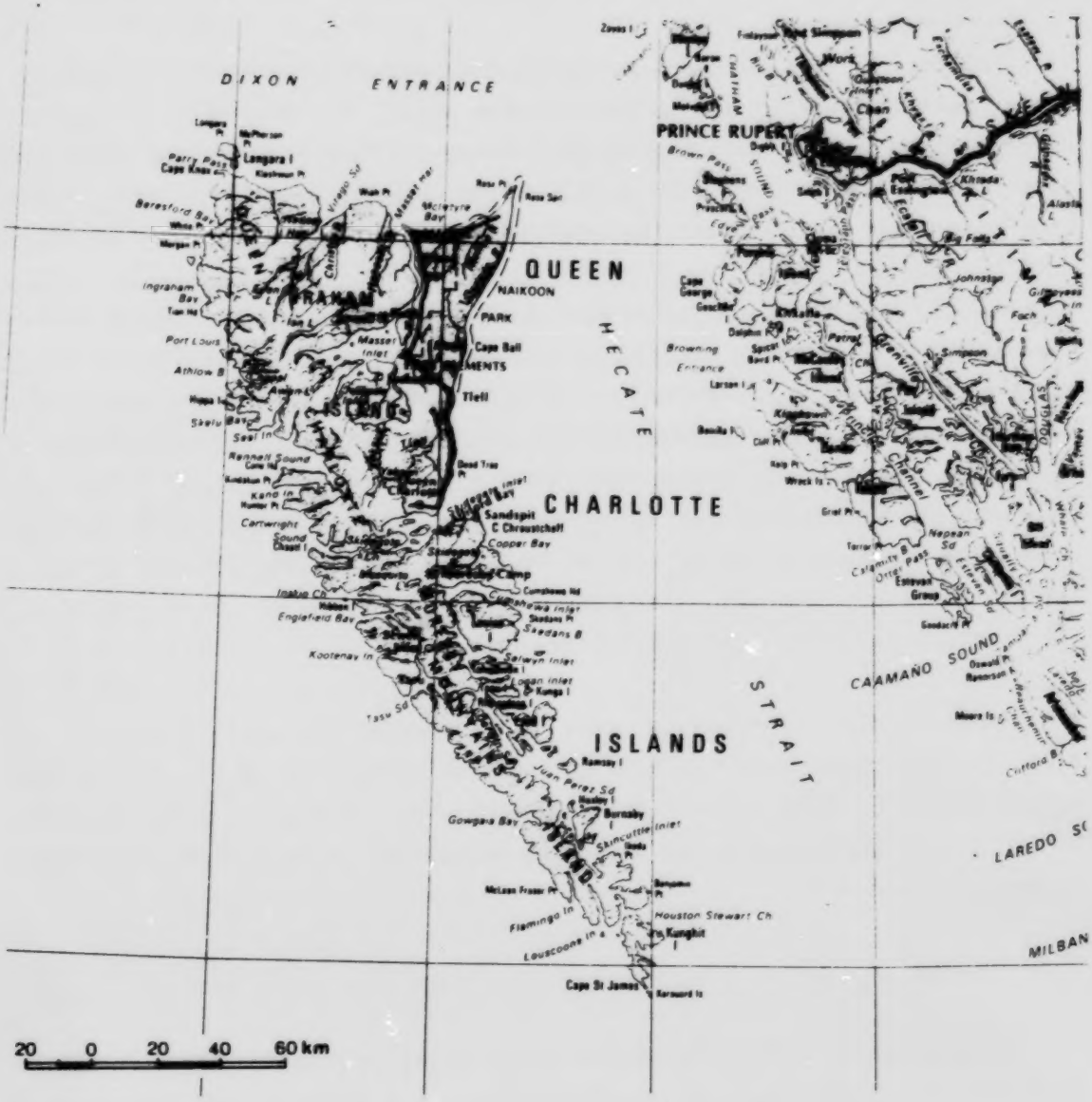


Figure 1

Location Map of the Queen Charlotte Islands (from NTS 103 NE & 103 SE)

STUDY PRODUCTS AND APPLICATIONS

The main products of this study are (i) digital, coastal zone resource maps and a linked data base; and (ii) microcomputer software for the display and printing of maps and data. In both cases, data and maps are organized into 44 geographic areas (corresponding to the map areas of the National Topographic System (NTS) 1:50,000 series) and 12 data types.

Data were compiled in 12 data types:

- coastal geomorphology
- coastal zone processes
- coastal zone plants
- invertebrates
- fish
- birds and mammals
- archaeological sites
- sites of historical and cultural significance
- sites of aesthetic, recreational and scientific significance
- sociopolitical features and coastal facilities
- commercial resource harvesting
- non-commercial resource harvesting

The digital maps and linked data base produced in this study are a state-of-the-art, interactive, geographic, information management system that will serve as a common data base for activities such as oil spill contingency planning, coastal zone planning, land-use planning, resource management, and interpretation of cultural heritage. Information in the system can be accessed easily and quickly accessed using either specifically configured microcomputers or mainframe computer systems. The maps and data base can be readily updated or extended to incorporate new data or new geographical areas or combined to produce derivative maps.

Each of the 44 base maps and associated 12 data types with linked non-graphic information are stored as a unity by the computers and are referenced by NTS map sheet number. Both versions of the system have passwords to control access to sensitive or confidential information.

Mainframe System

The mainframe computer version of the maps and data base was developed using Informap software, Synercom Technology Inc. graphics work stations, DEC computers (PDP 11 series), and a Calcomp 1075 drum/flatbed plotter. This installation of the system has sophisticated, interactive features that include:

- instantaneous display of selected mapped and linked non-graphic data records;

- capability of querying both the mapped and non-graphic components of the data base to search for specific configurations or combinations of coastal features and resources;

- capability of simultaneously displaying and overlaying multiple data types; and

- "windowing in" on selected areas.

The mainframe version provides final user-specified products in a variety of forms including magnetic tapes; computer-generated, hard-copy (paper) listings of non-graphic parts of the data base; and hard-copy maps produced in colour at a scale and quality specified by the user.

Microcomputer System

The microcomputer version of the maps and data base runs on an IBM PC (or compatible) microcomputer and dot matrix printer. Software was developed during this study to download all the information from the mainframe computer to a microcomputer. The microcomputer system is menu-driven, and its capabilities now include:

- password system and capability of changing passwords;
- display of all mapped data on a video-display terminal;
- overlay of data types;
- listing of non-graphic data on a dot-matrix printer;
- printing of maps on a graphics-capable printer; and
- windowing in on user-selected areas of maps.

The microcomputer version is the most readily accessible version of the system, and a user's manual with detailed explanations of the system's capabilities and how to use it is available as a separate document.

Applications

There are a wide range of possible uses for this computer-based, coastal zone resource information system. Examples of a 1:50,000 map and overlays are presented in Figures 2a - 2f. These figures illustrate the principle of overlays on which the computer system is organized. Figure 2a, showing the coastline and names of coastal features is bound into this report. Examples

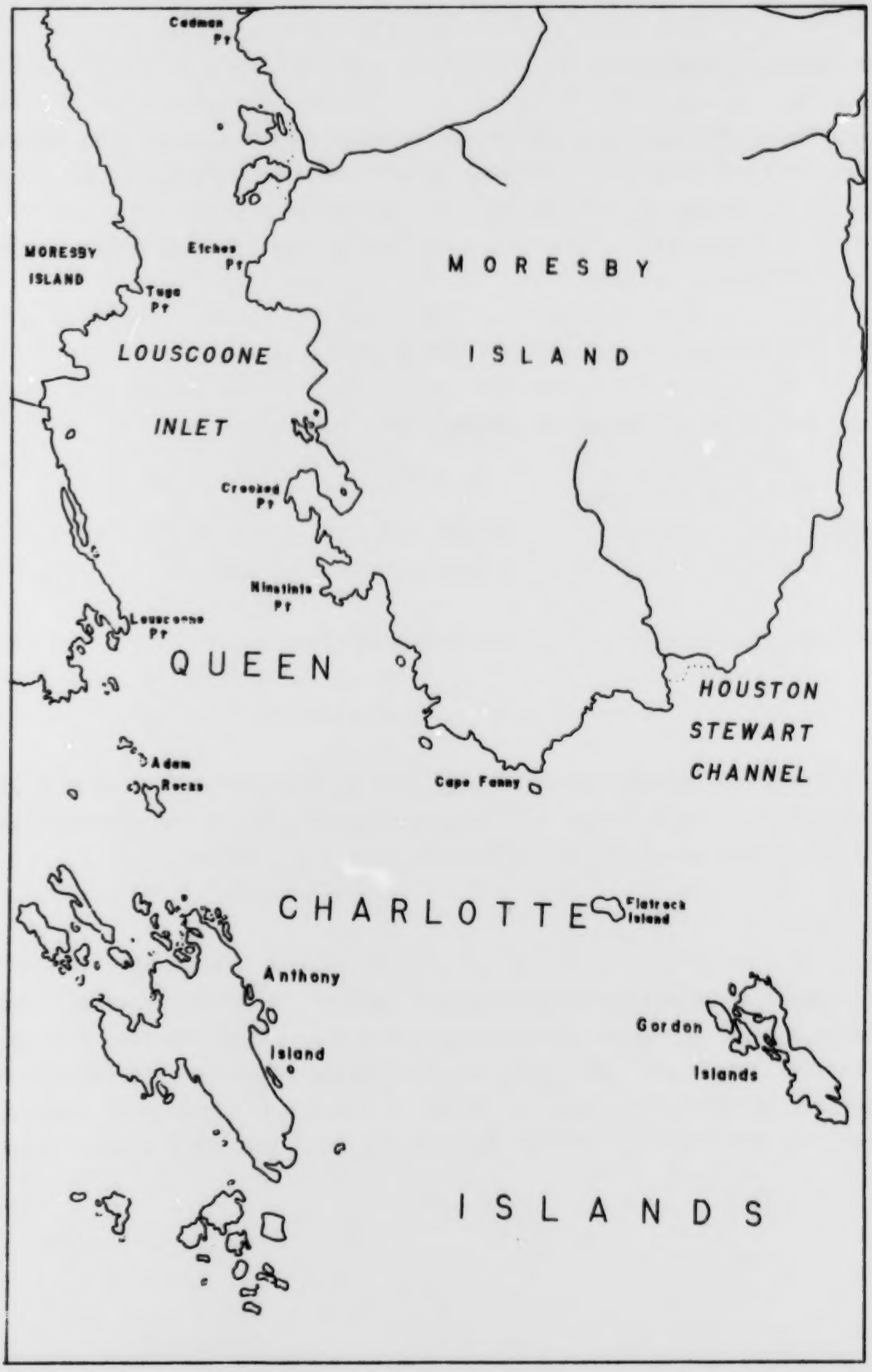


Figure 2a

Example of 1:50,000 Map (section from NTS Sheet 103B/3E) **and Overlays** (enclosed in pocket at back of report)

of overlays prepared on transparent acetate are included in the pocket at the back of this report as Figures 2b - 2f. Various combinations of overlays can be placed on Figure 2a to examine relationships between different data types.

Some examples of possible uses of the system are as follows:

(1) The system could be used to generate maps showing the significance of coastal resources and their sensitivity to specific effects (e.g., log storage and spills of crude oil). Derivation of such maps could be done by computer with additional information provided on the sensitivity or protection priority to be attached to particular resource types or features.

(2) The data base and digital maps could be used to evaluate the potential effects of proposed, site-specific, coastal resource developments, including wharves, pipelines and sewage outfalls.

(3) The system could be used to establish priorities for further research and analysis of coastal zone resources with respect to specific features, resources and areas.

The most important attribute of the microcomputer and mainframe information systems is that they can be updated as new coastal resource information becomes available. In this way, these systems provide a dynamic tool for coastal zone resource management.

(Detailed information on how to access study products is provided in Appendix A.)

SENSITIVE INFORMATION

Effective oil spill contingency planning requires detailed, site-specific information on coastal zone resources and sites of special significance. However, legitimate concerns exist that some commercial and non-commercial resource harvesting areas and sites of special spiritual, cultural, recreational and archaeological significance could be exploited or damaged if information about them became publicly available. Because of these concerns, a computer password system was developed to protect selected data types containing sensitive or confidential information. The password will be known only to selected ESRF personnel and selected individuals or agencies.

DATA GAPS

Data gaps are assessed in terms of the general completeness of information in each data type. There is considerable variation among data types in their completeness for use in spill contingency plans and various other purposes. In most cases, the absence of mapped information does not indicate that a species or feature is absent from an area, but rather that an area has not been systematically surveyed for the species or feature in question. Many data gaps also reflect the lack of information on species of little or no commercial value. Data gaps for each data type are discussed in detail in the "Data Collection and Overview" section of this report.

Complete and detailed assessments of the completeness of each data type in the data base for specific spill contingency planning purposes may require information not yet available. Information needed for a complete assessment of data adequacy includes location of potential spill source(s), likely spill trajectories, travel times of spilled oil, factors affecting weathering of oil and time of year.

STATEMENT FROM THE COUNCIL OF THE HAIDA NATION

Participation by the Council of the Haida Nation in this project occurred in the setting of a jurisdictional dispute between the Haida Nation and the governments of Canada and British Columbia. Notwithstanding this, the Council of the Haida Nation has long recognized the need for a comprehensive information base for proposed activities within Haida Gwaii.

Participation by the Council of the Haida Nation in this aspect of developing the information base was on an advisory basis focussing on co-operation in development of the best possible information base for Haida Gwaii. Also, the Council of the Haida Nation felt it was necessary to oversee the data base.

Specifically, the objectives of the Council of the Haida Nation in participating in this project are as follows:

- to identify and assemble existing published data on Haida Gwaii (in specific information categories);

- to evaluate the quality of existing data;

- to define a "table of contents" for an adequate information base; and

- to develop a computer map system for local manipulation of an evolving data base.

METHODS

The study was accomplished in six stages between June 1984 and May 1986. Three of these stages - digitization of base maps, development of data sheets, and data transcription - focussed on digitizing, coding and formatting of information. Two stages - data collection and data review - compiled information from a variety of sources and an interview program in the Charlottes and later verified that information had been accurately mapped and entered into the data base. Finally, production of final study products involved making necessary revisions to the maps and data base and producing master tapes and microcomputer diskettes of the maps and data base as well as this report and the microcomputer user's manual. The work plan followed during the study is shown in Figure 3.

At the outset of the study, representatives of the ESRF, the Council of the Haida Nation, B.C. Ministry of Environment, Department of Indian and Northern Affairs, Department of Fisheries and Oceans, Department of Environment, Chevron Canada Resources Limited, Petro-Canada and Shell Canada Limited met with members of the study team to finalize the scope of the study. As a result of this meeting, decisions were made:

- to defer collection of information on Haida non-commercial resource harvesting until a decision point later in the study;

- to provide an expanded training program for three researchers chosen by the Council of the Haida Nation;

- to develop a microcomputer version of the system for displaying the data;

- to present a training course in the use of the microcomputer; and

- to hold a technical information meeting on the structure of the data base.

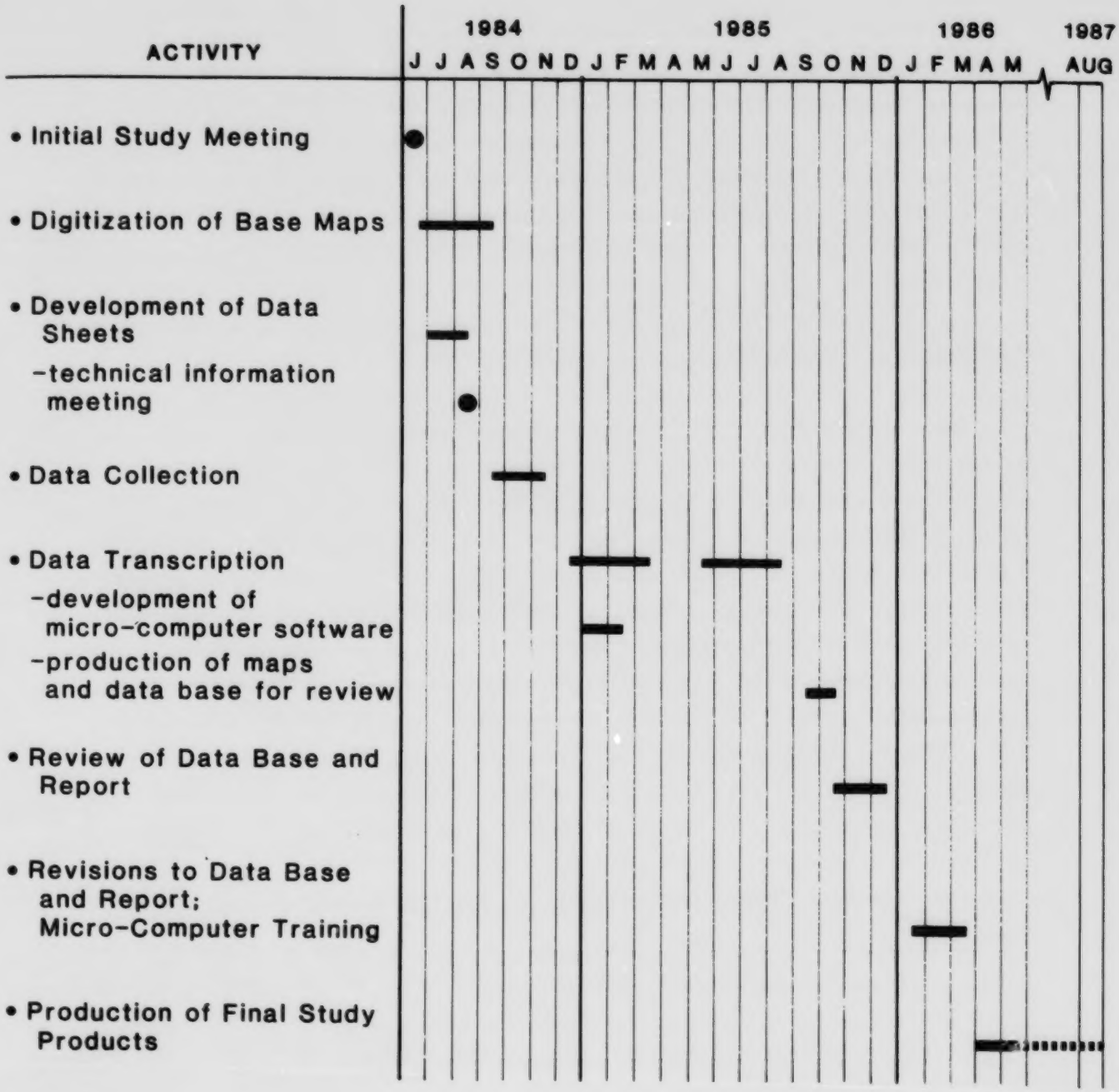

ACTIVITY
1984
1985
1986
1987
J J A S O N D J F M A M J J A S O N D J F M A M
AUG
• Initial Study Meeting
• Digitization of Base Maps
• Development of Data Sheets
-technical information meeting
• Data Collection
• Data Transcription
-development of micro-computer software
-production of maps and data base for review
• Review of Data Base and Report
• Revisions to Data Base and Report; Micro-Computer Training
• Production of Final Study Products

Figure 3

Study Work Plan

DIGITIZATION OF BASE MAPS

Maps were digitized on a Synercom Technology Inc. graphics work station using Informap software. Base maps were digitized from the 44 1:50,000 National Topographic Series (NTS) half sheets for the Queen Charlotte Islands. Information digitized from the topographic sheets included: coastlines, intertidal areas, terrestrial contours within about 500 m of the coastline, and annotation. In addition, the 20-m bathymetric contour was digitized from charts issued by the Canadian Hydrographic Service and was transformed to 1:50,000.

DEVELOPMENT OF DATA SHEETS

Data sheets were developed for coding relevant non-graphical attributes of the data. The format of the data sheets allows this information to be used to query the data base and to display mapped information with specific attributes. Members of the study team designed five data sheets for coding information on ten different data types. Data for two data types (coastal geomorphology and coastal processes) were coded using a special data-entry computer program as explained under "Data Collection and Overview". A technical information meeting involving representatives of Environment Canada, Environmental Protection Service, Department of Fisheries and Oceans, B.C. Ministry of Environment, Council of the Haida Nation, Chevron Canada Resources Limited and the Scientific Advisers of the study was held to discuss and review the data sheets before data collection began.

The five data sheets (see Appendix B) and the data types coded on each sheet are:

- Biological Data Sheet:

o coastal zone plants
o invertebrates
o fish
o birds and mammals;

- Archaeological Sites Data Sheet:

o archaeological sites;

- Significant Sites Data Sheet:

o cultural and historical sites
o aesthetic, scientific and recreational sites;

- Sociopolitical Features and Coastal Facilities Data Sheet:

o sociopolitical features and coastal facilities; and

- Resource Harvesting Data Sheet:

o commercial resource harvesting
o non-commercial resource harvesting.

DATA COLLECTION

The appropriate data sheets and one set of 1:50,000 NTS map sheets were used to compile information for each data type. The data collection program focussed on existing information sources with certain exceptions as noted. The objective was to build a data base that was as faithful as possible to the original information sources. Consequently, data have been recorded on data

sheets with minimal interpretation or transformation. Complete bibliographic references accompany each data record so that a user can go directly to the source of each.

The data collection program only included existing information that could be mapped at a scale of 1:50,000 in the data base. Information at much larger scales (e.g., 1:1,000,000) is referenced in this report but has not been incorporated into the data base. Similarly, inferences based on existing information have not been incorporated into the data base. For instance, the data bases on coastal geomorphology and non-commercial resource harvesting could be used to make inferences about the distribution of certain invertebrates and marine plants in areas where they have not been surveyed. Although this may be an obvious application of the data base, it was beyond the scope of this study to undertake this type of analysis or interpretation.

Specific methods of data collection and data sources for each of the 12 data types are discussed in "Data Collection and Overview".

DATA TRANSCRIPTION

Information on the data sheets and 1:50,000 NTS map sheets used to compile data was transcribed directly into the computer. Non-graphic information on the data sheets was entered into the computer by a data-entry operator working at a computer terminal. Mapped information from the map sheets was digitized at a graphics work station. The work station operator checked each non-graphic record that had been entered previously into the computer as the corresponding mapped information was digitized. Proof plots of all of the maps and a computer listing of all the non-graphic information were produced for each data type for review purposes.

Data were entered by NTS map sheet. For each data type, the mapped and non-graphic parts of each data record have the same unique record number. In

cases where a single data record occurs on two or more adjacent map sheets, the non-graphic data record has been entered into the data base once for each map sheet it includes and will be displayed for each map sheet.

DATA REVIEW

A data review was undertaken to ensure that all of the information collected during the study had been digitized accurately and entered into the computer. Individuals who provided information to the study were given an opportunity to review the digital maps produced by the computer and a computer listing of the data base to check them for correctness. Digital maps and the data base were made available to staff at Pacific Biological Station, Canadian Wildlife Service and B.C. Ministry of Environment for review.

In the Queen Charlotte Islands, a series of meetings was held in (new) Masset, Port Clements, Sandspit, Queen Charlotte City, Skidegate and (old) Massett. These meetings were advertised with posted signs, on CBC-Prince Rupert, and in the Queen Charlotte Islands Observer, the local weekly newspaper. The meetings were designed to give people an opportunity to learn about the existence and potential uses of the system, as well as to correct mistakes in the graphical and non-graphical parts of the data base, and to suggest additions to the data base. The meetings were, in general, poorly attended. Individuals who did attend were, for the most part, very knowledgeable, and suggested many small corrections (more than 100) as well as a number of important additional sources of information. Very few mistakes were noted in the non-commercial resources harvesting data base, after a careful review of it by the researchers who originally conducted the interview program.

DATA COLLECTION AND OVERVIEW

This section describes data collection methods for each data type, presents an overview of each data type and describes significant and unique features of each data type. Major data gaps are also identified for each data type.

The overview of each data type is presented at two levels. A general overview for all of the Queen Charlotte Islands points out major features and trends of each data type and identifies particular strengths and weaknesses in the data base. More detailed descriptions of each data type are presented for each of eight regions of the Charlottes.

The 44 1:50,000 map sheets have been divided into eight regions (Figure 4). These regions or groupings of NTS sheets of the Queen Charlotte Islands were defined because they are relatively homogeneous in terms of coastal geomorphology and biology. Although somewhat arbitrary, these regions provide manageable units for general discussion and description of the coastal zone.

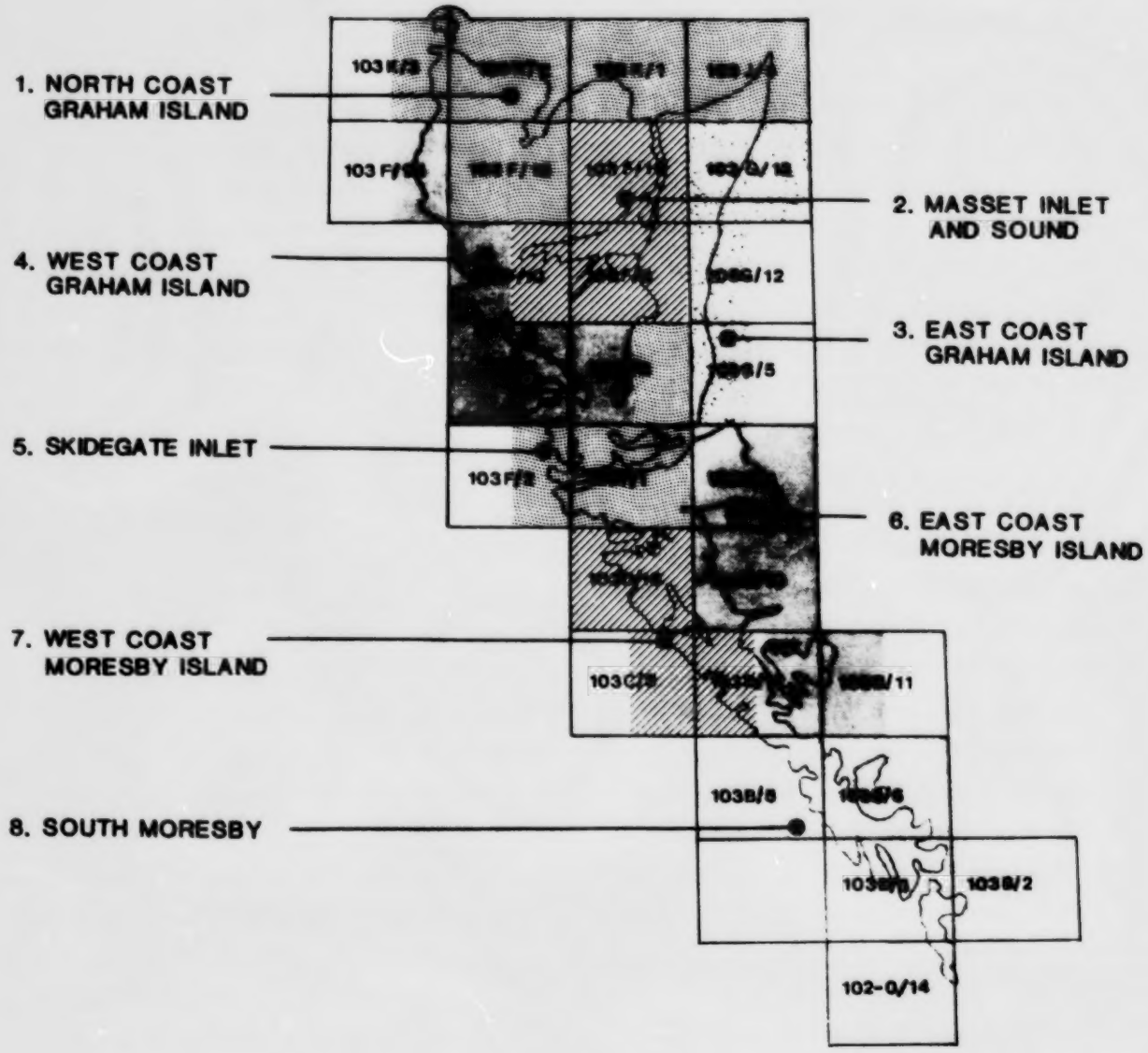


Figure 4

NTS Map Sheets in Major Regions of Study Area

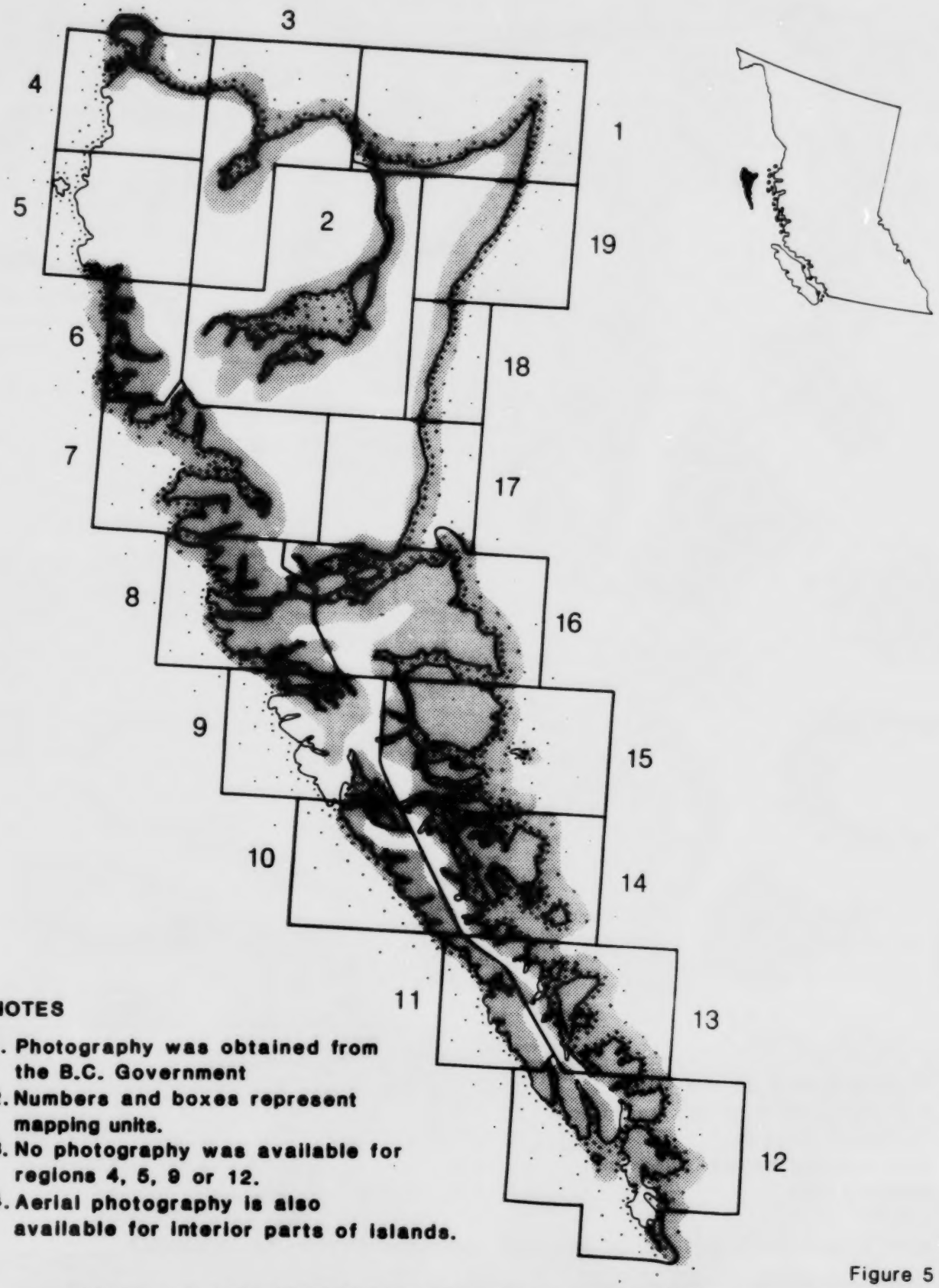
COASTAL GEOMORPHOLOGY AND PROCESSES

Data Collection

All information on coastal geomorphology and processes of the Queen Charlotte Islands was extracted either from previous coastal studies, of which there are few, or from aerial imagery analyses. The information included detail on the across-shore morphology, substrate type (shore-zone sediments on which organisms might attach or inhabit), and wave fetch, which provides an index of wave exposure. No field studies were undertaken as part of this study. The results represent a reasonable approximation of conditions on the coast and can be used directly in oil spill sensitivity analyses or in coastal zone management programs.

The principal source of information for coastal geomorphology was aerial imagery, including (a) vertical aerial photos from the B.C. government, (b) oblique aerial photos (35-mm slides) from the Geological Survey of Canada, and (c) oblique aerial videotape imagery from the B.C. Ministry of Environment. Coverage of the Queen Charlotte Islands from these three sources was nearly complete (Figures 5, 6, 7), and the sources complemented each other in scale. Aerial photos provided a meso-scale picture of the coast (i.e., capable of resolving features a few hundred metres in length) whereas the oblique slides provided considerable detail on substrate type (i.e., capable of resolving features in the range of 1 m in length or width). The aerial photos provided continuous coverage of the coastal zone whereas the slides provided discontinous coverage.

Previous studies of the Queen Charlotte Islands coastal geomorphology are rare, particularly in terms of actual field observation and/or measurements. Regional coastal mapping programs are presented in Chevron Canada Resources Limited (1982) and Petro-Canada (1983), but these analyses were derived from remote sensing imagery only. Harper (1980a, b) reported on field

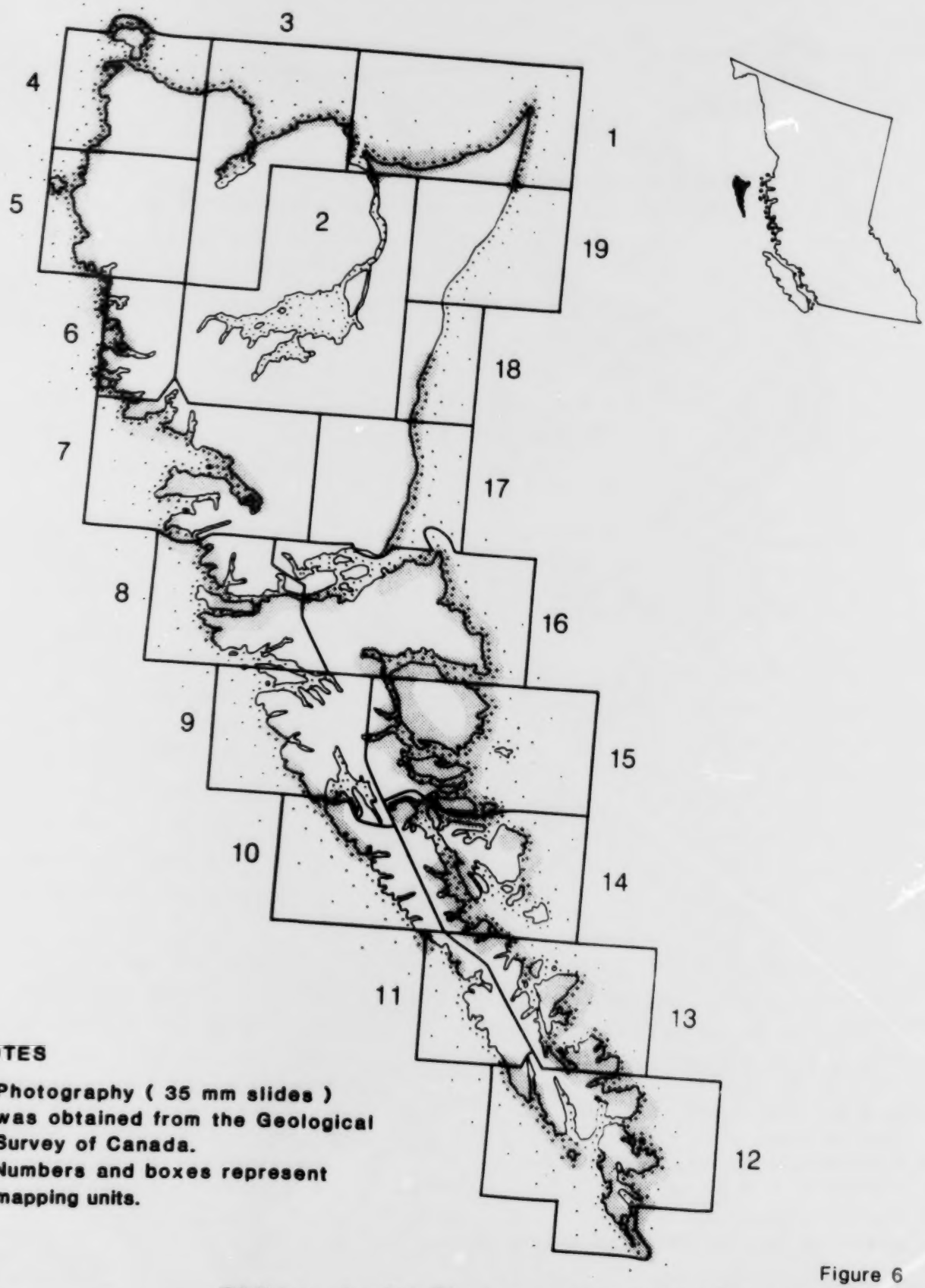


NOTES

1. Photography was obtained from the B.C. Government
2. Numbers and boxes represent mapping units.
3. No photography was available for regions 4, 5, 9 or 12.
4. Aerial photography is also available for interior parts of islands.

Figure 5

Vertical Aerial Photography Coverage of the Coastal Zone
QUEEN CHARLOTTE ISLANDS

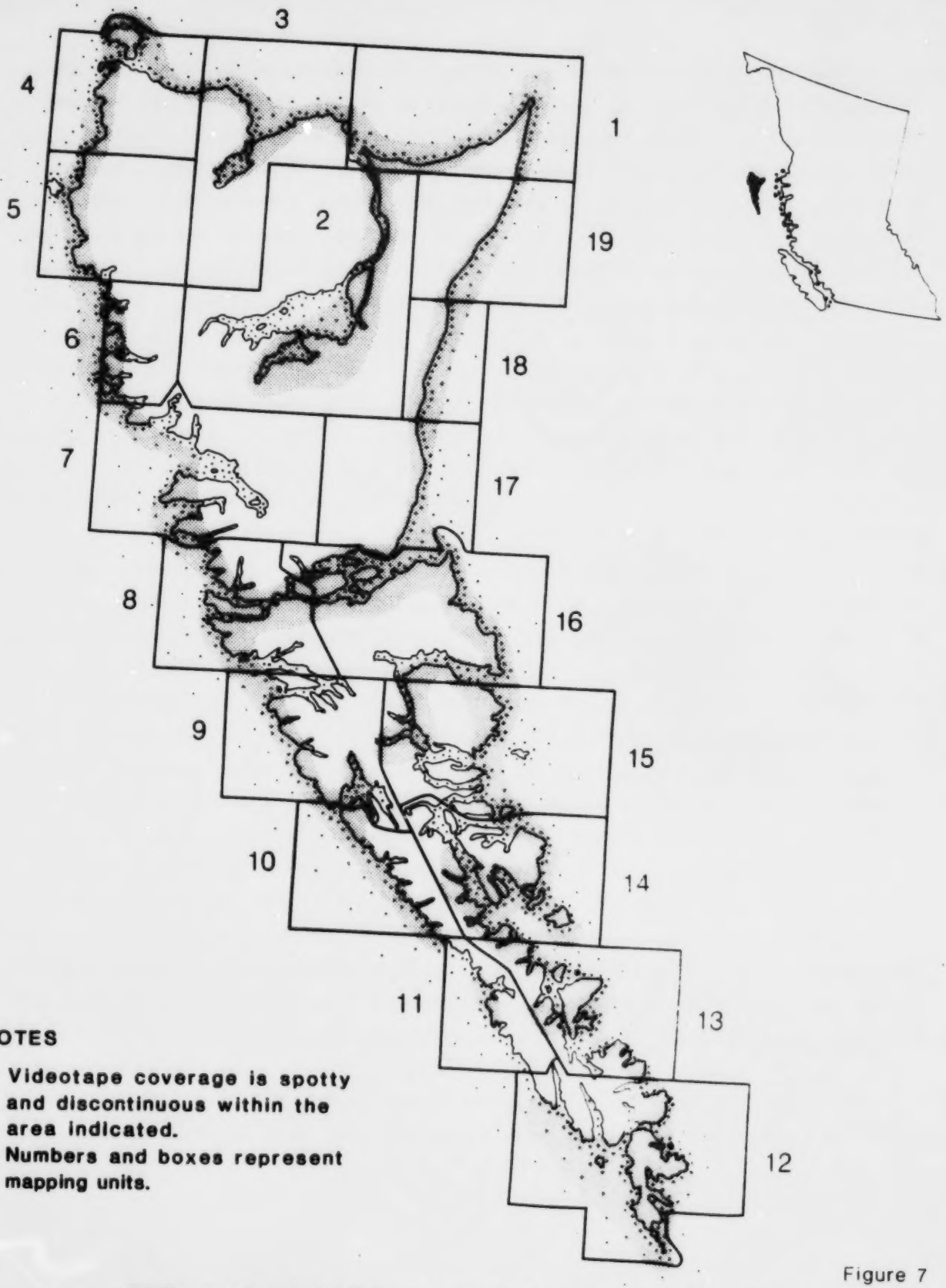


NOTES

1. **Photography (35 mm slides) was obtained from the Geological Survey of Canada.**
2. **Numbers and boxes represent mapping units.**

Figure 6

Oblique Aerial Photography of the Coastal Zone
QUEEN CHARLOTTE ISLANDS



NOTES

1. **Videotape coverage is spotty and discontinuous within the area indicated.**
2. **Numbers and boxes represent mapping units.**

Figure 7

Oblique Aerial Videotape Coverage of the Coastal Zone
QUEEN CHARLOTTE ISLANDS

investigations on the northeastern segment of Graham Island, and McLaren (1985) described effects of a fuel-oil spill on the east coast of Graham Island in 1983. There have been no systematic field surveys of coastal geomorphology on any of the southern part of the southern Charlottes to our knowledge. Recent studies of the nearshore (less than 20 m in depth) substrates have been completed along the northern section of the coast (Offshore Surveys and Positioning Services Ltd. 1985a, b). These data sources were consulted and, where appropriate entered into the data base.

In the data-acquisition program used to record information on coastal geomorphology and processes, information on each shoreline segment was entered into the data base using a menu-driven program. The entire coastal zone of the Queen Charlotte Islands was subdivided into small segments and each was assigned an identification number. A data record exists for each coastal segment and includes as a minumum: morphology, substrate type and wave-exposure level. Ancillary information, such as longshore transport direction or coastal stability, could also be entered. The methodology associated with this mapping procedure has been described more completely by Owens (1980), Harper (1981) and Harper et al. (1985). The mapping procedure is essentially the same as that adopted by the Geological Survey of Canada for the Coastal Information System (CIS) (Forbes and Fricker 1984).

The coastal classification is descriptive in nature as outlined by Owens (1980) and Harper and Sawyer (1983). Each across-shore component of morphology and substrate is described in the data base. Once the detailed mapping is completed, the data base is reviewed for repetitive groupings of across-shore components. These repetitive groupings of across-shore components are called coastal types and are illustrated on the geomorphology maps. Each coastal type represents a generalization of more specific data, which are recoverable from the data base.

Wave fetch, an index of wave-exposure and an important factor influencing biological and cultural usage, was determined for each coastal segment.

Effective fetch of each coastal segment was estimated using a modified procedure from CERC (1977) where the fetch distance was measured and averaged along three rays at (a) right angles to the coastal segment, (b) -45° from right angles and (c) +45° degrees from right angles. Maximum fetch distances for each coastal segment were also measured to provide an index of possible swell influence. In some cases, although the effective fetch distance is very small (i.e., the coastal segment is sheltered), the maximum fetch distance is large which indicates that the segment is probably subject to swells generated at a distance. The wave exposure information is summarized on the coastal processes maps and is derived from the geomorphology data base (i.e., it represents a generalization of more specific information contained in the data base).

Data Overview

The geomorphology of the coastal zone is summarized in terms of nine coastal types (Table 1), each categorized in terms of erosional and depositional features. Because of high wave exposure most of the high-relief coast of the Charlottes is erosional in nature, although erosion rates in bedrock may be very slow. Erosional landforms include a wide variety of rock cliffs, wave-cut rock platforms, and coarse-sediment beaches. Depositional coastal landforms occur mostly in the form of sand beaches and tidal flats, which are often associated with fjord-head deltas.

The distribution of coastal landforms by regions is summarized in Table 2. Of 4,375 km of shoreline mapped, Region 3, the east coast of Graham Island, has the shortest shoreline length (101 km) whereas Region 8, south Moresby Island, because of the highly crenulated nature of the shoreline has the longest length (987 km). No distinctive regional trends exist with respect to the distribution of coastal types with the exception of the comparative paucity of rocky shorelines along the northern and eastern portion of

TABLE 1

Coastal Types of the Queen Charlotte Islands

Coastal Type	Variety	Description
EROSIONAL LANDFORMS		
Cliffed Coast	-	a common coastal type of the west and south coasts consisting of steep rock cliffs with a narrow intertidal zone (<10 m) which is devoid of sediment; often associated with high wave exposure.
Rock Platforms	Narrow, sediment-veneered	narrow (<10 m wide) platforms with a thin sediment veneer; sediment is typically sand and gravel-sized rubble from associated cliffs, mobile sediment may prevent intertidal algae growth.
	Wide, sediment-deficient	wide platforms, typically 50 to 100 m in width, devoid of any sediment cover; platform width is variable with numerous surge channels and other irregularities.
	Wide, sediment-veneered	wide platforms, typically 50 to 100 m in width, with veneer of sand and gravel (veneer usually thin, <1 m).
	Wide, with beach	a wide (50 - 100 m) platform with a well-formed beach in the upper intertidal zone; beaches are typically comprised of gravel (pebble-cobble) but may be sand.

TABLE 1 (Continued)

Coastal Types of the Queen Charlotte Islands

Coastal Type	Variety	Description
Erosional Beaches	Narrow, coarse-sediment	comparatively narrow (<50 m in width) coarse sediment (sand, pebble and cobble.)
	Wide, coarse-sediment	usually greater than 50 m wide and composed of sand, pebble and cobble material with occasional boulders.
DEPOSITIONAL LANDFORMS		
Sand Beaches	-	sand beaches of moderate width (usually >50 m), indicating the accumulation of sand material; often associated with dunes; occasionally associated with erosional sand cliffs.
Tidal Flats	-	accretional areas of sand or mud accumulation (occasionally coarser material), usually at the head of inlets or fjords; often found in association with fjord-head deltas.

TABLE 2

Distribution of Coastal Types by Region

Region	Rock Cliffs	Erosional Landforms								Total	
		Rock Platforms (37.9%)				Erosional Beaches (21.2%)		Depositional Landforms			
		Narrow With Sediment	Wide Without Sediment	Wide With Sediment	Wide With Beach	Narrow Beach	Wide Beach	Sand Beaches	Tidal Flats	%	km
1. North Coast Graham Island	0.4	0.6	0.3	0.3	2.3	-	1.5	2.1	1.3	8.8	388
2. Masset Inlet and Sound	1.2	-	1.8	1.3	0.2	-	2.0	-	2.2	8.7	383
3. East Coast Graham Island	0.4	-	-	-	-	0.5	0.3	1.1	-	2.3	101
4. West Coast Graham Island	4.2	0.7	2.4	1.8	2.5	-	1.7	-	0.5	13.8	608
5. Skidegate Inlet	4.2	0.2	1.5	0.9	0.4	0.1	2.5	-	1.3	11.1	489
6. East Coast Moresby Island	5.3	0.1	5.1	1.3	1.2	1.2	5.0	0.5	0.8	20.5	903
7. West Coast Morseby Island	6.0	0.5	1.7	1.3	0.1	-	1.6	0.1	0.4	11.7	516
8. South Moresby	7.1	0.4	4.6	3.0	1.4	-	4.8	0.1	1.0	22.4	987
Total%	28.8	2.5	17.4	9.9	8.1	1.8	19.4	3.9	7.5	100.0	
Total km	1,269	110	767	436	357	79	854	172	330		4,375

Graham Island and the correspondingly higher concentration of beaches in those areas. Other than these two exceptions, the coastal landform are distributed is comparatively uniformly among the mapping units.

The existing data base is reasonably comprehensive and characterizes coastal landforms with spatial extents in excess of 100 m accurately for most of the Charlottes. Similar data sources were used for all areas so that there should be little to no variation in data quality as a function of geographic location. Less than 1% of the coastline (40 km, consisting of 25 km of the west coast of Graham Island and 15 km in Masset Inlet) was unmapped for lack of photographic imagery (Figures 5, 6, 7). The coastal geomorphology data base thus provides adequate detail for most coastal zone management needs and, in particular, for regional assessments of resources and regional sensitivity analyses. Additional field surveys are unlikely to alter geomorphologic classifications significantly although substrate characterization is likely to be improved at specific locations.

Coastal processes are summarized principally in terms of tidal range, wave exposure and coastal currents. These processes provide a basis for description of the ocean dynamics that are important in shaping the coastline, in controlling the distribution of nearshore and intertidal organisms, and in limiting the potential cultural use of the coastal zone.

Tidal characteristics of the region (Table 3) indicate that the mean range of tides on the Queen Charlotte Islands varies from 1.2 m in Masset Inlet (large tide range to 1.6 m) to 5.1 m in Skidegate Inlet (large tide range to 7.9 m). The variability is important because the tidal range affects the vertical and horizontal extent of intertidal organisms. Areas of large tidal range include much of the open coast of the Queen Charlotte Islands, whereas sheltered Masset Inlet, has a comparatively small tidal range.

TABLE 3

Tidal Range of Coastal Segments on the Queen Charlotte Islands

Region	Range of Mean Tides (m)	Range of Large Tides (m)
1. North Coast Graham Island	3.4	5.3
2. Masset Inlet and Sound	1.2	1.6
3. East Coast Graham Island	2.9	4.3
4. West Coast Graham Island	3.0	4.5
5. Skidegate Inlet	5.1	7.9
6. East Coast Moresby Island	3.7	5.5
7. West Coast Moresby Island	2.9	4.5
8. South Moresby	3.0	4.7

Source: Canadian Hydrographic Service 1985.

The wave exposure indices calculated suggest the wave energy levels for each coastal segment (Table 4). Regionally, the Queen Charlotte Islands are characterized by similar proportions of high and low wave-exposure shorelines and a smaller proportion of moderate wave-exposure areas. This pattern of wave-exposure reflects the highly crenulated nature of the coast where headlands receive high exposure to waves and inlets are relatively protected from waves.

Northern, western and southern coasts of the Queen Charlottes (Regions 1, 4, 7, 8) face the open Pacific Ocean and are dominated by exposure to high waves with waves in excess of 30 m (Carey 1979). Higher proportions of low wave-exposure shore occur in Masset Inlet (Region 2), Skidegate Inlet (Region 5), and eastern and western Moresby Island (Regions 6 and 7).

Coastal currents are not well documented for the Queen Charlotte Islands but can be described generally in terms of their three major components. Coastal currents typically are comprised of tidal, wind-driven, and wave components. Tidal currents are most significant in narrow channels and inlets where wave fetches are restricted and tidal velocities are accentuated. Wind-driven currents can occur along any segment of coast but are generally small (typically 3% of wind speed), compared to currents of up to 1 m/s (2 knots) generated by breaking waves. Wave-generated currents are most important in transporting sediment along the coast.

Coastal current patterns have not been documented, however, coastal morphology provides indirect indications of net current direction. The extensive beach-ridge plain on the northeastern corner of Graham Island indicates a net drift of sediment to the east along the north coast and to the north along the east coast (from Skidegate to Rose Spit). Elsewhere sediment material is sufficiently scarce that net current directions cannot be determined from coastal morphology.

TABLE 4

Wave-Exposure Levels of Coastal Segments of the Queen Charlotte Islands

Region	High Wave Exposure (%)	Moderate Wave-Exposure (%)	Low Wave-Exposure (%)	Total for Region (%)
1. North Coast Graham Island	6.2	0.8	1.8	8.8
2. Masset Inlet and Sound	-	2.7	6.0	8.7
3. East Coast Graham Island	2.3	-	-	8.7
4. West Coast Graham Island	8.7	2.5	2.5	13.8
5. Skidegate Inlet	2.8	1.7	6.6	11.1
6. East Coast Moresby Island	5.6	5.5	9.4	20.5
7. West Coast Moresby Island	4.8	0.5	6.4	11.7
8. South Moresby	13.0	3.3	6.1	22.4
TOTAL	43.4	17.0	38.8	100.6

Region 1: North Coast of Graham Island. The north coast of Graham Island includes a wide range of coastal types and processes, including the exposed rocky shores of northwestern Graham Island and Langara Island and the long, continuous, sand beaches of northeastern Graham Island. Most of the coast is exposed to open Pacific swell generated by the frequent westerly and northwesterly winds and is predominantly a high wave-exposure shoreline. The section of coastline in Virago Sound (Naden Harbour) is a low wave-exposure coast because of the limited wave fetch.

Wave-cut rock platforms, usually backed by a narrow gravel beach (cobbles and sand), are the most common type of shoreline morphology west of Masset Inlet. Tidal flats occur locally within Naden Harbour. To the east of Masset Inlet, the shore zone is characterized by spectacular, wide, sand beaches, unique in British Columbia because of their length. Extensive backshore dunes are associated with the beaches, and progradation rates of about 0.5 m/y have led to the development of a wide beach-ridge plain, up to 10 km in width in places.

The source of sediment for the north coast beaches is offshore. As the sediment moves onshore, it is transported westwards near Masset and eastwards near Rose Spit. Erosion of coastal cliffs near Cape Ball on the east coast provides an abundant amount of sediment to the shore zone and this sediment is transported northwards towards Rose Spit. Large blow-out-type dunes occur just southeast of Rose Point.

Region 2: Masset Inlet and Sound. Masset Inlet is a unique area of the Queen Charlottes characterized by uniformly low wave-exposure and tidal range less than 2 m, even during large tides. Although the tidal range is low, tidal velocities in the channel proper may exceed 3 m/s (6 knots) in the narrow channel with the large volume of water that is exchanged during each tide.

Sediment is comparatively common within the inlet, with most of the shoreline having some beach component (see Table 2), even along the rocky sections. Rock platforms with and without beaches are common within the area. Wide, erosional beaches of gravel material are also common. Tidal flats occur near the heads of small inlets and bays, and are more common in this area than in any other region.

Region 3: East Coast of Graham Island. The eastern shore of Graham Island is dominated by erosional beaches ranging from coarse gravel (cobbles and boulders) to sand. Although rock cliffs occur locally in the Lawn Hill area, actual outcrops in the intertidal zone are rare. Erosion of the beaches and backshore cliffs occurs primarily during southeasterly gales that generate large storm waves in Hecate Strait. The dominant direction for along-shore transport resutling from breaking waves is northwards.

Several unique coastal features exist along this segment of coast. Dunes and relict beach ridges occur in low backshore areas, particularly near the mouth of the Oeander River. Transverse bars (long, linear gravel bars that extend perpendicularly to the coast) are common in the Tlell-Lawn Hill portion of the coast. The wide, nearshore shoal that widens to 36 km in width near Cape Ball is unique to the Charlottes in that nearshore gradients are usually steep. The shoal is probably a land remnant that has disappeared as a result of rapid coastal retreat along this coast.

Region 4: West Coast of Graham Island. The west coast of Graham Island is dominated by exposed rock cliffs. Wave-exposure levels are among the highest in the world (Davies 1980). The straight coastline is broken by three inlets of which Rennell Sound is the largest. Rennell Sound is characterized by low-to-moderate wave exposure. Sedimentary bedrock, which crops out along the coast, promotes the formation of wide, intertidal rock platforms, which are the most common coastal type. Small sediment pockets may occur locally on the platforms near the mouths of streams. A significant proportion of the coast is characterized by narrow, intertidal zones where cliffs plunge nearly vertically into the sea.

Region 5: Skidegate Inlet. The Skidegate Inlet region includes a small portion of the exposed Pacific coast as well as the intricate channels associated with the inlet proper. Wave-exposure levels are predominantly low within the inlet and high on the outer coast (see Table 4). This region includes the widest variety of coastal types in all of the Charlottes (see Table 2). The predominant coastal type is steep rock cliffs with a narrow intertidal zone. Rock platforms occur within the area (mostly on the exposed outer coast) but are not common. Tidal ranges within this region are the highest in western Canada and may exceed 7.9 m during large tides.

Region 6: East Coast of Moresby Island. The eastern shore of Moresby Island is characterized by high coastal relief and a highly crenulated shore with numerous channels and inlets. The complex coastal configuration results in a variety of wave-exposure levels ranging from high wave-exposure in outer coastal areas to low wave exposure in inlets and channels. A significant proportion of the coast is also categorized as moderate wave-exposure.

The most common coastal type is steep rock cliffs that characterize many of the channel shores. Beaches, comprised mainly of gravel, are common on much of the Hecate Strait shoreline (e.g., the Sandspit area, and eastern Louise, Talunkwan and Lyell islands).

Region 7: West Coast of Moresby Island. This essentially straight coastline on the western shore of Moresby Island is broken by major embayments at Englefield Bay and Tasu Sound. A long segment of shoreline occurs within the two embayments and, consequently, most of the shoreline is classified as a low-energy shoreline. The outer coast is exposed to extremely large waves and has among the highest wave-exposure levels in the world. Coastal relief is high and, as a result, the major portion of the shoreline is characterized by steep rock cliffs. Sediment pockets occur locally near stream mouths.

Region 8: South Moresby. The south Moresby Island region includes both the southern tip of Moresby Island and Kunghit Island. Like the east coast of Moresby, the coastline is highly crenulated, with a variety of wave-exposure

levels. High wave-exposure predominates and moderate wave exposure is least frequent. The Cape St James area is renowned for the frequency of severe storms. The distribution of coastal types is highly variable (see Table 2) although steep rock cliffs with an associated, narrow, intertidal zone is the most common type. Rock platforms and erosional beaches are also significant coastal types within the region.

PLANTS

Data Collection

Little information is available on the distribution of various plants in the coastal zone of the Queen Charlotte Islands. The information source for marine plants was the Marine Resources Branch, B.C. Ministry of Environment, Victoria. Quantitative information was obtained from Coon et al. (1979) and Jenkins and Britt (1972). Observations on kelp bed locations were provided by Michael Coon.[1]

Data Overview

A large variety of plant species, predominantly marine algae, occur in the coastal zone. The only species that have been systematically surveyed in parts of the Charlottes are two kelp species, Nereocystis leutkeana and Macrocystis integrifolia. Table 5 indicates the regions where kelp bed surveys have been conducted and the types of surveys. No surveys have been conducted in Masset Inlet and Sound, Skidegate Inlet, or the west coast of Moresby Island. Except for the two kelp species, the data base does not contain information on plants of commercial or subsistence importance or plants of ecological importance. Thus, the data base may be incomplete for specific oil spill contingency plans and possibly other purposes.

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[1] M. Coon, Marine Resources Branch, B.C. Ministry of Environment, Victoria, personal communication, 1985.

TABLE 5

Surveys of Coastal Zone Kelps in the
Queen Charlotte Islands

Region	*N. leutkeana* Surveys	*M. integrifolia* Surveys	Mixed Kelp Surveys
1. North Coast of Graham Island	X	X	X
2. Masset Inlet and Sound	N/S	N/S	N/S
3. East Coast of Graham Island	N/S	S	N/S
4. West Coast of Graham Island	X	X	X
5. Skidegate Inlet	N/S	N/S	N/S
6. East Coast of Moresby Island	N/S	X	X
7. West Coast of Moresby Island	N/S	N/S	N/S
8. South Moresby	N/S	X	N/S

Note:
N. leutkeana = bullhead kelp
M. integreifolia = kelp
X = survey conducted
N/S = no survey
Mixed Kelp = *N. leutkeana* and *M. integrifolia*.

Regional Overviews of Plants

Region 1: North Coast Graham Island. This region has been extensively surveyed. The majority of the kelp beds surveyed were N. leutkeana. Kelp bed biomass for Nereocystis was greatest from Klashwun Point to Masset Harbour and least from Entry Point to Yakan Point. M. integrifolia biomass was greatest from Entry Point to Yakan Point.

Region 2: Masset Inlet and Sound. No kelp bed surveys have been conducted in this region.

Region 3: East Coast Graham Island. M. integrifolia has been surveyed at the mouth of Skidegate Inlet. Beds have been identified on the shores of Torrens and Jewell islands.

Region 4: West Coast of Graham Island. All three kelp bed types have been surveyed in this region. The beds are found along the coast of Graham Island from Frederick Island north.

Region 5: Skidegate Inlet. No kelp bed surveys have been conducted in this region.

Region 6: East Coast of Moresby Island. In this region, spot surveys of M. integrifolia and mixed kelp bed surveys have been conducted in Cumshewa Inlet, the southeast tip of Moresby Island, and Juan Perez Sound.

Region 7: West Coast of Moresby Island. No kelp bed surveys have been conducted in this region.

Region 8: South Moresby. M. integrifolia beds have been surveyed in Burnaby Strait, Skincuttle Inlet, Carpenter Bay and Houston Stewart Channel.

INVERTEBRATES

Data Collection

The main source of information on invertebrates was the Pacific Biological Station, Research Branch, Department of Fisheries and Oceans (DFO), Nanaimo, B.C. Data that can be mapped at 1:50,000 exist for only nine species of invertebrates that occur in the Queen Charlotte Islands. Information on abalone was obtained from Breen et al. (1978) and Breen and Adkins (1979). Additional data on abalone, which are not site-specific, are provided in Breen and Adkins (1981). Incidental observations on red sea urchins obtained during the abalone surveys were provided by Paul Breen.[1] Intertidal data for razor clams were obtained from Bourne and Quayle (1970). Neil Bourne[2] provided the general locations of beaches where butter and littleneck clams are known to occur.

Data from prawn traps were obtained from Boutillier et al. (1980) and Boutillier et al. (1981). Data on tows for sidestrip shrimp were obtained from Carmichael and Boutillier (1980). Prawn sets and shrimp tows start at depths of about 20 m and extend deeper. Many of these sets and tows were made in narrow passages close to shore, but technically these surveys fall outside of the coastal zone as defined in this study. Because of their proximity to shore, the total number of sets and tows has been recorded to indicate intensity of sampling. Information on catch size can be obtained from the appropriate references for each data record.

Information on Dungeness crab, based on information obtained from fishermen, was provided by Dwight Heritage.[3] Information on the scallop resources has not been included as the surveys were conducted outside the

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1 P. Breen, Pacific Biological Station, Nanaimo, B.C., personal communication, 1984.

2 N. Bourne, Pacific Biological Station, Nanaimo, B.C., personal communication, 1984.

3 D. Heritage, Pacific Biological Station, Nanaimo, B.C., personal communication, 1984.

coastal zone at depths greater than 20 m. Information on geoducks was obtained from the Marine Resources Branch of the B.C. Ministry of Environment, Victoria, B.C. Robert Cox[1] provided the field notes from a 1978 geoduck survey.

Surveys of invertebrates have been biased to species of commercial value in areas of commercial harvesting. This bias is reflected in the invertebrate maps and data base compiled in this study. Consequently, the absence of data in the data base does not indicate the presence or absence of a particular species.

Data Overview

A diversity of invertebrates occurs in the coastal zone of the Queen Charlottes, but data on only nine of these species are included in the data base as follows:

- abalone
- geoducks
- razor clam
- butter clam
- littleneck clam
- sidestrip shrimp
- prawn
- Dungeness crab
- red sea urchins

Surveys have been conducted in some parts of the Charlottes for five of these species: abalone, geoducks, razor clams, sidestrip shrimp and prawns. Incidental information is available for the other four species: butter and littleneck clams, Dungeness crab and red sea urchins. Table 6 summarizes, by region, the sampling intensity for each of the nine species.

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[1] R. Cox, Marine, Resources Branch, Ministry of Environment, Victoria, B.C., personal communication, 1984.

TABLE 6

Regional Summary of Invertebrate Surveys in the Queen Charlotte Islands

Region	Abalone No. of Survey Sites	Geoducks No. of Transects	Razor Clams No. of Transects	Butter and Littleneck Clams	Sidestripe Shrimp No. of Tows	Prawns No. of Sets	Dungeness Crab	Red Sea Urchins
1. North Coast of Graham Island	N/S	76	10	obs	N/S	2	obs	N/S
2. Masset Inlet and Sound	N/S	N/S	N/S	N/S	N/S	N/S	obs	N/S
3. East Coast of Graham	N/S	58	N/S	N/S	N/S	2	obs	N/S
4. West Coast of Graham Island	N/S	N/S	N/S	N/S	N/S	12	N/S	N/S
5. Skidegate Inlet	N/S	N/S	N/S	obs	N/S	18	N/S	N/S
6. East Coast of Moresby Island	82	63	N/S	obs	5	110	N/S	obs
7. West Coast of Moresby Island	N/S	N/S	N/S	N/S	2	44	N/S	N/S
8. South Moresby	55	N/S	N/S	obs	N/S	40	N/S	obs

Note:
N/S = no survey conducted
obs = observations

The existing information on distribution of invertebrates is incomplete in terms of both geographical coverage and species surveyed. Existing data are biased towards a small number of commercially harvested species. Even for the few species for which there are data, there are important geographical gaps. For example, no information is available on the distribution of abalone on the north coast of Graham Island, yet substantial commercial harvests of abalone have been made from this region. Similarly, no information is available on the distribution of Dungeness crabs in coastal areas adjacent to the north coast of Graham Island, yet this region has been an important area for commercial crab fishing for most of this century. Information on the distribution and abundance of geoducks on the west coast of Moresby Island is lacking, yet in 1985 a substantial geoduck fishery was sustained in Tasu Sound. There are many other examples of the inadequacy of existing sources of information on commercially important invertebrates. No information is available on species that are not of current commercial importance. For example, loligo squid are known to be widely distributed throughout coastal areas of the Queen Charlotte Islands, but their distribution has never been systematically documented.

In summary, the invertebrate data base is incomplete. Further evaluation of the data base would be required before use in oil spill contingency planning.

Regional Overviews of Invertebrates

Region 1: North Coast of Graham Island. Geoducks, razor clams and prawns have been surveyed in this region. Geoducks were only found on 5 of the 76 (50 m x 2 m) transects surveyed. These five transects were located in Virago Sound and McIntyre Bay. Razor clams have been surveyed from Masset to Rose Spit. Higher populations of razor clams are found in the low intertidal zone and in the Tow Hill to Rose Spit portion of the survey area. Two prawn surveys have been conducted along the northwest tip of Graham Island. Based on information obtained from fishermen, Dungeness crab are found in Naden Harbour, Virago Sound and McIntyre Bay.

Region 2: Masset Inlet and Sound. Dungeness crab is the only invertebrate species documented for this region. Populations of Dungeness crab can be found throughout Masset Inlet and Sound.

Region 3: East Coast of Graham Island. Along the east coast of Graham Island, Dungeness crabs are present from Rose Spit to Cape Ball. Fifty-eight geoduck transects were surveyed and geoduck siphons were observed on only two transects near the north tip of the island. Two prawn sets were made in Hecate Strait north of Skidegate. The remaining invertebrate species have not been surveyed in this region.

Region 4: West Coast of Graham Island. Prawns are the only invertebrates that have been surveyed in this region. The majority of the sets were located in Rennell Sound. Prawns were found in Shields Bay.

Region 5: Skidegate Inlet. Butter and littleneck clams have been observed along the beaches of Skidegate Inlet. The only other invertebrate species documented for this region is prawns. Sets have been made in Cartwright Sound and Skidegate and Inskip channels. Of these three areas, prawns were only trapped in Cartwright Sound.

Region 6: East Coast Moresby Island. The greatest concentration of surveys for invertebrates has been along the east coast of Moresby Island. Seven of the nine species have been reported in survey results. Abalone surveys have been conducted in the eastern portions of Cumshewa and Selwyn inlets; along the east coast of Moresby, Louise and Lyell islands; and Darwin and Juan Perez sounds. Geoduck transects have been sampled in Cumshewa Inlet and in Hecate Strait along the east coast of Moresby Island. Geoducks were observed on 6 of the 63 transects. Butter and littleneck clams have been observed on beaches in Cumshewa Inlet and Darwin and Juan Perez Sounds. Sidestripe shrimp have been surveyed in Cumshewa and Selwyn inlets and Juan Perez Sound. The number of prawn sets was greatest along the east coast of Moresby. Prawn traps have been set throughout the area. Juan Perez Sound between Perez Shoal and Marco Island produced some of the best sets. Darwin

Sound produced the next largest catch. Red sea urchins have been observed along the east coast of Moresby Island and throughout Darwin and Juan Perez sounds.

Region 7: West Coast Moresby Island. Sidestripe shrimp and prawns are the only invertebrate species that have been surveyed in this region. Surveys have been conducted in Moore Channel and Tasu Sound. The highest prawn catches were found in Fairfax Inlet in Tasu Sound.

Region 8: South Moresby. Abalone and prawns have been surveyed in this region. Abalone survey sites were located on the east coasts of Burnaby, Moresby and Kunghit islands. The surveys indicated that abalone stocks were relatively small in Skincuttle and Poole inlets and Carpenter and Collison Bays. Prawn sets have been conducted throughout the inlets on the east and west coasts of Moresby. Butter and littleneck clams have been observed on the beaches in Burnaby Strait. Red sea urchins have been observed in Burnaby Strait and the east coasts of Moresby and Kunghit islands.

FISH

Data Collection

Researchers at the Pacific Biological Station in Nanaimo and management biologists with the North Coast Division of the Field Services Branch, DFO, provided most of the information on finfish stocks, primarily herring and Pacific salmon. The following specific sources of information were used in preparing the data base:

- an unpublished report on the distribution of herring spawning grounds in the Queen Charlotte Islands (Herring Section, Pacific Biological Station);

- reports on "run reconstruction" of British Columbia sockeye and pink salmon stocks (Starr et al. 1984; Henderson and Charles 1984);

- personal knowledge of K. Hyatt[1] and K. Wiley;[2]

- computerized data base on stream escapement from DFO fisheries statistical areas 1, 2E and 2W for all five species of salmon from 1947 to 1984 (Department of Fisheries and Oceans 1984 a,b,c,d).

Other sources did not provide information that could be mapped at a scale of 1:50,000, but appropriate reference to these sources is made in the "Data Overview."

Data Overview

The best-developed source of information on the finfish resources of the Queen Charlotte Islands is the salmon-escapement data base. However, this data base has many limitations as a result of inaccurate escapement estimates, and perhaps, more importantly, inconsistency in escapement estimation (Symons and Waldichuk 1984). This information, together with a long, time series of information on the distribution and abundance of herring spawn, forms the basis of the finfish resource component of the maps and data base.

Information on other stages in the life history of salmon and herring (e.g., smolt abundances, juvenile rearing areas) and on other species (groundfish) is essentially non-existent. The little available information has been summarized in the government responses to the additional information requirements for the West Coast Offshore Exploration Environmental Assessment Panel process (Government of Canada and Province of B.C. 1985). This information is insufficient in detail to be included in the data base. With an almost complete lack of information on the use of coastal areas by juvenile salmonids and on other finfish species, the fish data base must be considered incomplete.

Production of chum and pink salmon predominates in the river and stream systems of the Queen Charlotte Islands (Shirvell and Charbonneau 1984). There are significant differences in salmon production between the three DFO statistical areas (Figure 8) that surround the islands. Area 1, at the north

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[1] K. Hyatt, Pacific Biological Station, DFO, Nanaimo, B.C., personal communication, 1984.

[2] K. Wiley, MacLaren Plansearch Corp., Vancouver, B.C., personal communication, 1984.

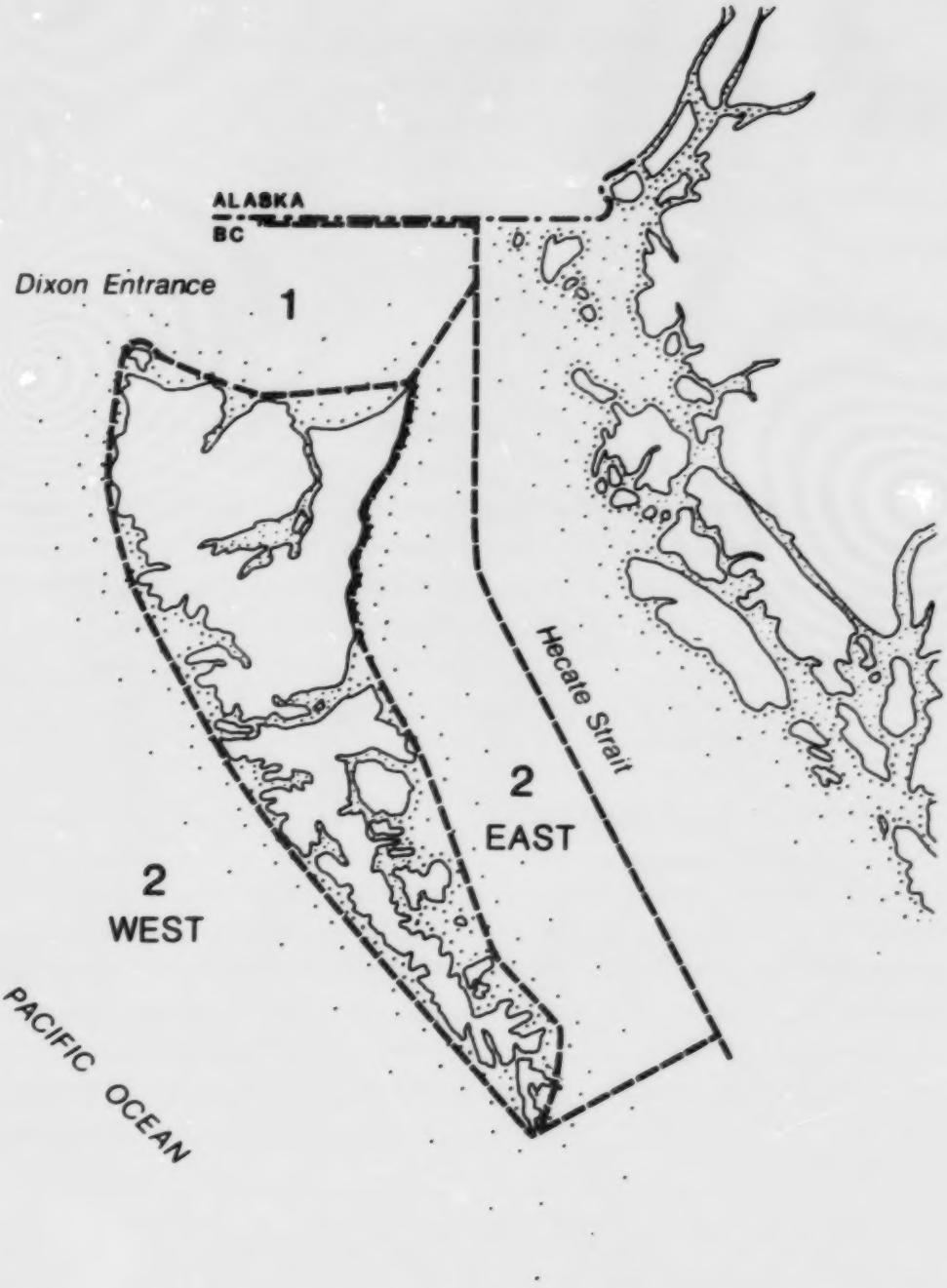

Figure 8

DFO Statistical Areas

QUEEN CHARLOTTE ISLANDS

end of Graham Island, produces more coho salmon than any of the other areas; area 2E, corresponding to the east of the islands, is generally the most productive area; and area 2W, off the west coast of the islands, is the least productive area.

Salmon escapements, in general, to Queen Charlotte Islands streams have declined by about two-thirds since 1948. Pink and chum salmon escapements have declined the most. Coho and sockeye escapements have been relatively stable. The severity of escapement declines varies between DFO statistical areas, with the most serious declines in pink salmon escapement occurring in area 1, and the largest declines in chum salmon escapement occurring in areas 2E and 2W.

Examination of the escapement data base reveals that 29 (6%) of the total number of salmon populations in the Queen Charlotte Islands have become extinct since 1947 (Shirvell and Charbonneau 1984). Most of the extinctions have been coho and pink salmon populations from areas 2E and 2W. The mean annual rate of extinction is increasing, and is now four populations per year. Extinctions and near extinctions have changed and are threatening to change the ecological diversity of many stream systems from chum, coho and pink salmon production to only chum salmon production.

Regional Overviews of Fish

Region 1: North Coast of Graham Island. This region is notable for the production of coho, and to a lesser extent, chum salmon. However, coho salmon escapements in this region have declined seriously (Shirvell and Charbonneau 1984). The Naden River is the most productive salmon river in this region, particularly for chum, pink and coho salmon. Davidson Creek, which discharges to Naden Harbour, is also an important producer of coho and pink salmon. The Parry Passage area has been identified as an important area for juvenile salmon-rearing (Government of Canada and Province of B.C. 1985).

Naden Harbour is an area of major importance for herring spawning, which also occurs in and the Inskip and Mary Point areas.

Region 2: Masset Inlet and Sound. This region is one of the most important areas in the Queen Charlotte Islands for the production of salmonids. The largest river in the islands, the Yakoun River, discharges into Masset Inlet and is the only chinook salmon producing river in the islands. The chinook escapement has declined seriously since the 1960s, and now averages 800 fish per year.

The Yakoun River is also a major producer of even-year pink salmon. Fourteen other pink salmon streams discharge to Masset Sound and Inlet. Pink salmon escapements to these streams have declined, on average, by 75% since 1947.

Coho salmon escapements to streams in this region have not declined significantly. The major coho producers are the Mamin and Yakoun rivers. The Ain and Awun Rivers are the most important chum salmon streams in the region.

The southwest part of Masset Sound and the waters surrounding Kumdis Island are thought to be important rearing areas for juvenile salmonid (Government of Canada and Province of B.C. 1985).

Region 3: East Coast of Graham Island. The only two salmonid-producing streams on the east coast of Graham Island are the Tlell River and Jungle Creek. The Tlell River is most important as a coho salmon producer, but is also a spawning and juvenile rearing area for Pacific cod and rock, English and butter sole (Government of Canada and Province of B.C. 1985).

Region 4: West Coast of Graham Island. Coho production from 5 inlets and 16 streams on the west coast of Graham Island is of minor importance, and has declined by 75% since the 1960s. Some important pink salmon streams in this region include Kano Inlet Creek and Bonanzo Creek which discharges to Shields Bay. Of 20 chum-producing streams, the most important are Mace Creek (Athlow Bay) and Seal Inlet Creek.

According to spawn deposition records, Shields Bay, Tartu Inlet and Port Chanal are important as herring spawning areas. The most northerly part of this area is a juvenile salmonid rearing area.

Region 5: Skidegate Inlet. Twenty-two salmonid-producing systems discharge to Skidegate Inlet. The entire region is an important coho and chum salmon-producing area, with the most significant contributions coming from Honna, Deena, Lagins, Brown's Cabin and North Arm stocks. Brown's Cabin Creek is also a significant producer of pink salmon. This region is also a rearing area for juvenile salmonid (Government of Canada and Province of B.C. 1985) and an extremely important area for herring spawn deposition. Skidegate Channel stands out in this region as a herring spawning area.

Region 6: East Coast of Moresby Island. The complex inlet system formed by the east coast of Moresby Island and adjacent islands provides productive habitat for juvenile salmonid-rearing. The most important area for juvenile rearing is in Cumshewa Inlet (Government of Canada and Province of B.C. 1985). This rearing habitat, combined with production of salmonids from 37 small streams, makes this generally the most productive area for salmonids in the Queen Charlotte Islands. Most of the streams are small, and the major producers are the enhanced Pallant and Mathers Creek systems.

This region is an extremely important area for herring spawning. Cumshewa Inlet is a major spawn deposition area, as is Powrivco Bay. Beljay Bay and Takelley Cove are of secondary importance in this regard. Pacific cod and rock, English and butter sole spawn and rear off the northern part of the east Moresby Island coast. Spawning and juvenile rearing of the three sole species also occur in Cumshewa, Dana and Selwyn inlets.

Region 7: West Coast of Moresby Island. Coho salmon are produced from 18 streams in 2 inlet systems on the west coast of Moresby Island. The most significant coho producers are Fairfax Inlet Creek (in the Tasu Sound system) and Peel Inlet Creek. Coho salmon escapements to streams in this area have declined by 75% since the 1960s.

Even-year pink salmon are produced from 15 streams in the Tasu and Inskip Inlet systems. Kaisun and the Security Inlet creeks are the most important pink salmon producers. Chum salmon are produced from 23 streams in the same inlet system. Tasu and Botany Inlet creeks are the most important chum producers.

The only area on the west coast of Moresby Island where herring spawning has been consistently recorded is Inskip Cove.

Region 8: South Moresby. This region is the most important area for herring spawning in the Queen Charlotte Islands. Spawn deposition has been recorded consistently in Louscoone and Flamingo inlets, around Wanderer Island, and in the Poole Inlet - Blue Jay Cove area. The most important areas for herring spawn deposition are the Burnaby Strait area and the Burnaby - Section - Alder islands area.

There are 38 salmonid-producing streams in this region. Streams discharging to Flamingo and Louscoone inlets are important chum salmon producers. This region is also a very important area for juvenile salmonid rearing. Off Burnaby Island is an important rearing area for sablefish.

BIRDS AND MAMMALS

Data Collection

The principal sources of information on birds and mammals were the British Columbia Provincial Museum, B.C. Ministry of Environment, Canadian Wildlife Service, Pacific Biological Station of the Fisheries Research Branch (DFO), and unpublished field notes.

The amount of information and level of detail available on each group of birds or mammals is highly variable, which is reflected in the data base. For instance, considerable time and effort has been invested in surveys of

colonial seabirds and some surveys of winter waterfowl have been conducted. However, much less attention has been focussed on surveys of shorebirds, sea lions, or harbour seals. Some sources contain information that could not be mapped at a scale of 1:50,000. These sources are referenced in the appropriate places of the "Data Overview."

Data Overview

The coastal zone of the Queen Charlotte Islands provides important habitat for breeding, wintering and transient birds and mammals. The islands are world renowned for their abundance and diversity of coastal and marine birds. Seals, sea lions and other marine mammals occur throughout the islands.

The major groups of birds occurring in the coastal zone are sea birds, shorebirds, waterfowl and birds of prey. Breeding seabirds are an outstanding component of the islands' ecosystem. More than 600,000 pairs of seabirds breed in the Charlottes, and most of these are nocturnal, burrow-nesting species. The most abundant nesting seabirds in the Charlottes are: fork-tailed storm-petrel, Leach's storm-petrel, pelagic cormorant, glaucous-winged gull, common murre, pigeon guillemot, ancient murrelet, Cassin's auklet, rhinoceros auklet, and tufted puffin. Population estimates of these species are based on surveys conducted by the British Columbia Provincial Museum (1979), the Canadian Wildlife Service (Vermeer et al. 1983), and the ongoing Pacific Seabird Monitoring Program sponsored by the Canadian Wildlife Service. Although estimates of seabird populations are considered preliminary, they are generally felt to present a "reasonable picture" of seabird numbers and distribution (Vermeer and Sealy 1984).

Two species of breeding seabirds, marbled murrelet and horned puffin, are not included in estimates of seabird populations for the Charlottes. Marbled murrelets nest solitarily and few nests have been found, so population sizes are poorly known (Sealy and Carter 1984) and undocumented. Horned puffins breed in Alaska and have only recently been reported nesting in the Queen Charlottes in small numbers (Campbell et al. 1979).

Estimated numbers of seabirds nesting in the Queen Charlotte Islands are shown by species and region in Table 7. Among the most abundant breeding seabirds is the ancient murrelet which is at the southern extent of its range in the Charlottes. Fork-tailed and Leach's storm-petrels and Cassin's auklets are also abundant numbering in the tens to hundreds of thousands of pairs. Breeding pairs of alcids including pigeon guillemots, rhinoceros auklets and tufted puffins number in the thousands, whereas less than 100 pairs of common murres breed in the Charlottes. Nearly 2,000 pairs of glaucous-winged gulls and a few hundred pairs of pelagic cormorants also nest there.

Shorebirds occur in the Queen Charlotte Islands both as breeders and migrants. Among the shorebirds breeding in the coastal zone are black oystercatchers, semipalmated plovers, and least sandpipers. Many shorebirds including plovers, yellow legs, dowitchers, phalaropes, sandpipers, dunlin, turnstones and sanderlings (Hearne, unpublished field notes)[1] that breed at higher latitutes stop in the Charlottes during their migration. Sandhill cranes also breed there. Shorebirds have not been surveyed in a comprehensive fashion except in a few places such as Delkatla Wildlife Sanctuary near Masset.

Waterfowl, including breeders, migrants and winter residents, are a prominent feature of the coastal zone of the Charlottes. Their abundance varies seasonally. Loons, grebes, swans, geese, dabbling and diving ducks occur throughout the islands. Over the years, surveys of waterfowl in the Charlottes have been conducted by the Canadian Wildlife Service, B.C. Ministry of Environment, and others. The Waterbird Data System, a computer data base, developed by the Wildlife Branch of the B.C. Ministry of Environment is the most comprehensive collection of information on waterfowl of the Queen Charlotte Islands. Because of differences in scale, data from the Waterbird Data System have not been incorporated into this system, but the system is referenced at appropriate places in this report.

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[1] M. Hearne, Delkatla Wildlife Sancturary, personal communication, 1984.

TABLE 7

Estimated Numbers of Breeding Pairs of Seabirds
in the Queen Charlotte Islands[1]

REGION	SPECIES										
	Fork-tailed Storm Petrel	Leach's Storm Petrel	Pelagic Cormorant	Glaucous-winged Gull	Common Murre	Pigeon Guillemot	Ancient Murrelet	Cassin's Auklet	Rhinoceros Auklet	Tufted Puffin	Totals
1. North Coast Graham Island	3,500	4,500	72	168		130	22,500	200		8	31,078
2. Masset Inlet and Sound				31		24+					55
3. East Coast Graham Island											
4. West Coast Graham Island	15,779	15,679	90	363		85	108,498	103,700		22	244,216
5. Skidegate Inlet	50	10,300	34	94		50	11,350	9,740	200	325	32,143
6. East Coast Moresby Island	8,407[2]	P[2]	164	429		521	40,813	16,738			67,072
7. West Coast Moresby Island	9,000	9,000		34		4	200		25+		18,263
8. South Moresby	39,996[2]	P[2]	74	893	50	372	70,888	104,842	13,803	3,185	234,103
TOTALS	76,732	39,479	434	2,012	50	1,186	254,249	235,220	14,028	3,540	626,930

[1] Estimates are based on surveys conducted by the British Columbia Provincial Museum in 1977 (British Columbia Provincial Museum 1979) and the Canadian Wildlife Service in 1982-85.
[2] Estimates are for total storm petrels as surveys were too early to determine species composition. P = present.

Bald eagles and peregrine falcons occur along the coast of the Queen Charlotte Islands and both species obtain almost all of their food from the coastal zone. Falcons feed almost exclusively on seabirds whereas eagles feed on seabirds, fish and marine invertebrates. Surveys of eagle nests have only been conducted along parts of eastern Moresby Island (South Moresby Resource Planning Team 1983). Peregrine falcon eyries are usually situated close to seabird colonies and locations of many eyries are well-known. However, because of concern about poachers taking young peregrines from the nests, Canadian Wildlife Service and B.C. Ministry of Environment staff requested that locations of nests not be included in the data base.

A variety of marine mammals is found in the waters around the Queen Charlottes, but only a few of these spend time in the coastal zone as defined in this study. Steller sea lion rookeries, year-round haulouts and winter sites have been documented for all of British Columbia including the Queen Charlotte Islands (Bigg 1984). River otter den sites have been documented in some seabird colonies by Canadian Wildlife Service seabird researchers. Harbour seals are common along all of coastal British Columbia, but they have not been systematically surveyed in the Charlottes. Grey whales and Dall porpoises are often seen close to or within the coastal zone, but no systematic surveys of these mammals have been undertaken. Consequently, no records of harbour seals, grey whales or Dall porpoises are included in the data base.

The bird and mammal data base has a number of important data gaps that limit its usefulness for oil spill contingency planning. Although the information on numbers of breeding seabirds is relatively complete, staging areas for colonially nesting seabirds are not completely documented. Staging and wintering areas used by a diversity of coastally migrating shorebirds and waterfowl have not been systematically catalogued. Data on nest sites of bald eagles and peregrine falcons are incomplete or lacking. Information on the use of the coastal zone by mammals is incomplete or lacking for all species except Steller sea lions.

Region 1: North Coast of Graham Island. Langara, Cox, and Lepas Bay islands are the main locations of nesting seabirds along the north coast of Graham Island. Ancient murrelets are the most abundant nesting seabirds on Langara Island. Thousands of pairs of fork-tailed and Leach's storm-petrels occur on Lepas Bay Island. Staging areas of ancient murrelets are located to the northeast and southwest of Langara. Bald eagles and peregrine falcons nest on Langara Island. River otters breed on Langara, and Steller sea lions and harbour seals use Langara as a haulout area.

Only small numbers of seabirds nest along the north coast of Graham Island between Langara Island and Rose Point. This area is used seasonally by various species of shorebirds and waterfowl and by sandhill cranes. Delkatla Wildlife Sanctuary near Masset is an important area for waterbirds which has been documented in Hearne's field notes. For other records of waterbirds along the north coast, the Waterbird Data System should be consulted.

Rose Spit is used as a haulout area by Steller sea lions (Bigg 1984) and harbour seals.

Region 2: Masset Inlet and Sound. Small numbers of glaucous-winged gulls and pigeon guillemots nest on some of the small islands in Masset and Juskatla inlets. Large numbers of waterbirds including geese, brant, dabbling and diving ducks and shorebirds spend parts of the fall, winter or spring in Kumdis Slough and Masset Inlet. Records of these birds are contained in the Waterbird Data System.

Region 3: East Coast of Graham Island. The east coast of Graham Island does not support any colonies of nesting seabirds, but a few pigeon guillemots have been recorded nesting on Torrens Island. A diversity of waterbirds occurs along the east coast of Graham, and their numbers vary dramatically through the year. More details on waterbird numbers in this area are in the Waterbird Data System.

The sandy spit extending north from Sandspit is a haulout used by Steller sea lions.

Region 4: West Coast of Graham Island. Major colonies of nesting seabirds occur on Frederick and Hippa islands along the west coast of Graham Island. Ancient murrelet staging areas are located near both islands. Smaller colonies of seabirds are located on small islands along this coast. Steller sea lion haulouts are located at Joseph Rocks and Hippa Island. Some waterbird surveys have been conducted along this coast, and details of the surveys are in the Waterbird Data System.

Region 5: Skidegate Inlet. Small numbers of glaucous-winged gulls and pigeon guillemots nest on islands in Skidegate Inlet, Bearskin Bay and Maude Channel. Larger colonies of seabirds occur on the islands at the northern end of Englefield Bay. Waterbirds concentrate in the area in the winter months. The Waterbird Data System should be consulted for additional information.

Region 6: East Coast of Moresby Island. Nesting seabirds occur on many of the islands along the east coast of Moresby Island. Islands with more than 1,000 pairs of nesting seabirds include Hoskins Islets, Ramsay, House, Agglomerate, Lyell, Reef, Limestone and Skedans islands. Bald eagle and peregrine falcon eyries are situated throughout the area, often in association with seabird colonies. Steller sea lions haulout at Skedans, Reef and Ramsay Islands. Waterbirds occur throughout the area, and details of their numbers can be obtained from the Waterbird Data System.

Region 7: West Coast of Moresby Island. Colonies of nesting seabirds, mostly petrels, occur in southern Englefield Bay. Small numbers of glaucous-winged gulls and pigeon guillemots nest on islands in Lomgon Bay. Steller sea lion haulouts are located on islands in southern Englefield Bay and at Chads Point and Tasu Head. During the winter, waterbirds occur throughout the area. More information on waterbirds can be found in the Waterbird Data System.

Region 8: South Moresby. Large numbers of seabirds nest along the coast of the South Moresby region. The largest colonies, numbering ten thousand to tens of thousands of pairs of seabirds, are Anthony Islands, Kerouard Islands (Cape St. James), Rankine Islands, Copper Islands, Bolkus Islands and Alder Island. Colonies with more than 1,000 pairs of nesting seabirds include those located on St. James and Langtry islands. Bald eagle and peregrine falcon eyries occur throughout the area. Waterbirds are seasonally common in the region, and more information on them is available in the Waterbird Data System. Steller sea lion haulouts are located at Wells Cove, Scudder Point on Burnaby Island, McLean Fraser and Nagas points. A sea lion rookery is located on the Kerouard Islands at Cape St. James.

ARCHAEOLOGICAL SITES

Data Collection

The primary source of information on sites of archaeological significance was the Archaeological Site Inventory maintained by the Heritage Conservation Branch of the B.C. Ministry of the Provincial Secretary and Government Services in Victoria. Information on archaeological sites in the Queen Charlotte Islands was obtained by reviewing the 1:50,000 maps on which all inventoried sites are recorded. The site-location designators (according to the Borden system) were used to access the specific information for each site from the inventory files.

Reports on archaeological investigations in the Skidegate Inlet area by the curators of the Queen Charlotte Islands Museum were also reviewed. However, all sites recorded in these reports were also included in the provincial Archaeological Site Inventory.

Data Overview

The Queen Charlotte Islands are believed to be extremely rich in archaeological sites. The maritime orientation of the Haida people, their extensive dispersion throughout the islands in pre- and post-contact periods as recorded in the ethnographic literature, and information contained in the historical and cultural sites data base in this study all support this belief. Although only about 250 archaeologial sites are recorded in the data base, archaeologists estimate that this number might represent only 2 to 5% of all discovered and undiscovered archaeological sites. This estimate is based on experience with intensive surveys designed to uncover archaeological sites elsewhere on the coast. Further evidence that discovered archaeological sites represent only a very small fraction of all sites is the density of archaeological sites in the Skidegate Inlet area, which has been intensively surveyed by staff from the Queen Charlotte Islands Museum. Based on these estimates, it is evident that the present data base on archaeological sites in the Queen Charlotte Islands is incomplete.

Additional information on archaeological sites has been collected by The Kunghit Cultural History Project undertaken by B.C. Heritage Trust, Petro-Canada and the Council of the Haida Nation. Data gathered during this project which was completed in the summer of 1986 have not been incorporated into the data base.

In general, the distribution of known archaeological sites along the coasts of the Queen Charlotte Islands reflects the allocation of investigative effort rather than the extent of pre-historic use of any particular area. For this reason, known archaeological sites are concentrated in the Masset-Tow Hill and Skidegate Inlet-Cape Ball areas, which are readily accessible to the communities of Masset-Haida and Skidegate-Queen Charlotte City.

The data base on archaeological sites is protected by a password. Users who do not know the password should contact the Heritage Conservation Branch in Victoria if they are interested in having access to the data.

Regional Overviews of Archaeological Sites

Region 1: North Coast of Graham Island. High concentrations of archaeological sites are found in the Lepas Bay-Kiusta area and in the Kumdis Island-Masset-Tow Hill area. Many of the archaeological sites in the Tow Hill area, in particular, show evidence of historic (as opposed to pre-contact) use. Most of the sites in these areas are either middens or collections of worked stone artifacts.

Region 2: Masset Inlet and Sound. Archaeological sites have been found in the Kumdis Island area.

Region 3: East Coast of Graham Island. The Skidegate-Cape Ball area has a high concentration of archaeological sites. These sites are also either middens or collections of lithic (stone) artifacts.

Region 4: West Coast of Graham Island. Only five archaeological sites - all middens - are recorded from the west coast of Graham Island. This low number of recorded sites reflects the remoteness of, and consequently the low level of archaelogical survey work in the area. There are doubtless many undiscovered archaeological sites in this area.

Region 5: Skidegate Inlet. Skidegate Inlet has a high concentration of archaeological sites, particularly in the Bearskin Bay-Lina Island area, which reflects the fact that the area has been relatively intensively surveyed. It is probably a culturally rich area.

Region 6: East Coast of Moresby Island. Two areas stand out in this archaeologically rich area; the Skedans area and Darwin Sound. The Skedans area is unique in having a large number of cave sites.

Region 7: West Coast of Moresby Island. Nine archaeological sites have been discovered on the west coast of Moresby Island. As on the west coast of Graham Island, the relatively low number of discovered sites reflects a lack

of archaeological survey effort, and not a low number of actual sites. There are many cave sites in this region, as well as the only petroglyph recorded from the Queen Charlotte Islands.

Region 8: South Moresby. South Moresby is ecologically and biologically rich, and this richness is probably also reflected in a relatively high concentration of archaeological sites. Three areas are outstanding:

- Kunghit Island-Anthony Island area, an area famous for the number of standing totem poles and house remains;

- Lyell Island-Hotspring Island area; and

- Burnaby Narrows-Skincuttle Inlet area, an area particularly notable for a large number of fish traps.

SITES OF HISTORICAL AND CULTURAL SIGNIFICANCE

Data Collection

The most important and comprehensive source of information on sites of historical and cultural significance was Kathleen Dalzell's two volume set of books about the history and place names of the Queen Charlotte Islands (Dalzell 1968, 1973). Much of the information in these books regarding sites of native historical and cultural significance was obtained from Swanton's books about Haida culture and society.

Data Overview

The most outstanding and striking feature of the data base on historically and culturally significant sites is the number of previously occupied or used Haida villages and fishing and hunting camps. About 170 such villages and camps are recorded in the data base located, throughout the coastal areas

of the islands. This number, and their widespread distribution attest to the extent to which Haida people used and occupied the lands and waters of the Queen Charlotte Islands in the pre- and early post-contact periods.

The existing information based on sites of non-native historical significance is probably complete for most coastal zone planning and contingency planning purposes, as it is based on a comprehensive review of the island history summarized in Dalzell's books (Dalzell 1968, 1973). The adequacy of the existing information base on sites of native cultural and historical significance is unknown, but it is anticipated that many more sites might be identified through an interview program if the sensitivity and confidentiality of the information could be protected and guaranteed.

Regional Overviews of Sites of Historical and Cultural Significance

Region 1: North Coast of Graham Island. The most important historical and cultural features of this area are the high concentrations of Haida villages in the Parry Passage, Naden Harbour, North Beach-Naikoon and Masset Inlet areas. The Parry Passage area was, and is, particularly important to native people for fishing, and there are many fishing camp sites in the area. Other important historical features are a whaling station in Naden Harbour and many sites of first contact between non-natives and natives. Captain George Dixon was involved in these contacts which were concerned with trading.

Region 2: Masset Inlet and Sound. Masset Inlet and Sound also have large numbers of Haida villages and, particularly, fishing camps. Historic commercial fish camps and canneries at Shannon Bay and Ferguson Bay are important historical features, as are a number of townsites (e.g., Graham Centre) that were supposed to become major population centres. Abandoned logging camps and sawmills are located at Shannon Bay, Buckley Cove and Ferguson Bay.

Region 3: East Coast of Graham Island. Pre-historic Haida villages and camps are dispersed along the entire east coast of Graham Island, from Rose

Spit to Skidegate, which is striking, given the relatively featureless nature of this coast.

Region 4: West Coast of Graham Island. The many Haida village sites on the west coast of Graham Island attest to former extensive use and occupancy by Haida people of a now largely unpopulated area.

Region 5: Skidegate Inlet. The intensive pre-historic and historic use of Skidegate Inlet by Haida people is evidenced by the large number of Haida villages and fishing camp sites in this area. Other notable historic features include fish canneries at Alliford Bay and South Bay and dogfish reduction plants at Skidegate and Skidegate Landing.

Region 6: East Coast of Moresby Island. Haida villages, fishing camps, hunting camps and fort sites are spread throughout the entire region. Other important historic features of this region include canneries and fish camps at Lockeport, Pacofi and Lagoon Bay, fish reduction plants at New Clew in Cumshewa Inlet and at Pacofi, and a number of abandoned mines and logging camps.

Region 7: West Coast of Moresby Island. Haida villages and fishing camps also dominate the cultural and historic landscape of this region. These sites attest to the extensive pre-historic use and occupancy by Haida people of this region, which is essentially unpopulated now that the Tasu mine is closed.[1]

Region 8: South Moresby. Abandoned mines at Jedway and Ikeda Cove, a whaling station at Rose Harbour which operated from 1910 to 1946, and an abandoned Japanese fish saltery at Jedway are important historic features of South Moresby. An extensive array of Haida villages and camps is located in this region.

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[1] In 1987, the B.C. government gave the Tasu townsite to the Haida for redevelopment.

SITES OF AESTHETIC, SCIENTIFIC AND RECREATIONAL SIGNIFICANCE

Data Collection

Sites of scientific significance were identified through the Ecological Reserves Unit of the B.C. Ministry of Lands, Parks and Housing. Both approved and proposed ecological reserves were included in the data base.

Sites of aesthetic significance were identified through the interview program on non-commercial resource harvesting. Interviewees were asked to name and locate on 1:50,000 NTS maps any areas of the coast of the Queen Charlotte Islands that they felt were particularly beautiful.

Recreational areas were identified in two ways: through the interview program and by interviewing the principals of Kallahin Expeditions, a wilderness tour-guiding company based in Queen Charlotte City. Additional information on coastal areas important for recreational purposes was obtained from tourist guide books (e.g., Carey 1983).

Information provided by individual tourism operators on sites of recreational significance is sensitive. ESRF must be contacted to arrange access to this information (see Appendix A).

Data Overview

The Queen Charlotte Islands are rapidly becoming an important destination for wilderness-oriented tourists. This is largely the result of media exposure of the unique beauty, interesting natural features, diverse marine and bird life, and fascinating cultural history of the "Canadian Galapagos" as well as the publicity surrounding the South Moresby land-use controversy.

The islands also have many sites of scientific significance. Unglaciated refugia from the last glacial period and the barriers Hecate Strait and Dixon Entrance pose to the dispersal of some forms of life have created many sites of scientific interest. However, the only readily accessible source of information on sites of scientific significance is the register of Ecological Reserves maintained by the B.C. Ministry of Lands, Parks and Housing. There may be many more sites of scientific significance noted in academic journals and books. The data available for specific coastal zone and contingency planning purposes may be incomplete.

The data base on sites of aesthetic and recreational significance could also be improved through interviews of additional wilderness tour guides operating in the islands. The following brief descriptions of key aesthetic and recreational features cannot do justice to the vast and diverse array of features that make the Queen Charlotte Islands such a unique place.

Regional Overviews of Sites of Aesthetic, Scientific and Recreational Significance

Region 1: North Coast of Graham Island. The two recreational "core areas" in this region are the Lepas Bay-Kiusta-Beresford Bay area and the Langara Island area. A spectacular feature of the first-named core area is the 30-km golden sand beach in Beresford Bay. Both core areas provide excellent beachcombing. Delkatla Slough is a site of recreational (bird-watching) and scientific significance. Other significant sites in this region include the Tow Hill-Rose Spit area, and Naden Harbour, which is also an important staging area on waterfowl migration routes.

Region 2: Masset Inlet and Sound. The scenic lagoons, bays and estuaries of Masset Inlet are important recreational and aesthetic features of this region. The historic features of the region (fishing camps and processing facilities, old logging camps, and homesteads) are also notable recreational features. The Yakoun Bay-Kumdis area is a particularly significant recreational area for fishing and bird-watching.

Region 3: East Coast of Graham Island. The extensive beaches in this region are a recreational asset, particularly for hikers. The Tlell River area also has recreational (fishing, picnicing) and aesthetic significance.

Region 4: West Coast of Graham Island. The beaches in this region provide excellent beach-combing, and the nearby islets and islands (Tian, Frederick and Marble) are good areas for viewing seabirds (e.g., cormorants). Some of the inlets in this region, such as Van Inlet, are steep-sided and scenic.

Region 5: Skidegate Inlet. The entire Skidegate Inlet region is a recreational and aesthetic core area. The many interesting archaeological and historical features in this area include a number of old fish-processing facilities. The western part of this region is very scenic, with spectacular waterfalls and narrows.

Region 6: East Coast of Moresby Island. The numerous recreational and aesthetic features of this region are some of the main reasons why increasing numbers of tourists are coming to the Queen Charlotte Islands. Important features include excellent fishing opportunities, scenic tidal flats and lagoons, tidal bores and rapids (e.g., Louise Narrows, Lagoon Inlet), remains of historic and pre-historic fish traps, historic minesites and fish camps, seal and sea lion concentrations, seabirds, scenic rock formations and a tremendous diversity of types and sizes of beaches.

Region 7: West Coast of Moresby Island. This region provides excellent beach-combing and has scenic, steep-sided, and in some cases, sheltered inlets (e.g., Kootenay Inlet). There are also some beautiful estuaries on the west coast of Moresby Island.

Region 8: South Moresby. The numerous recreational and aesthetic features of this region, include seabird colonies, sea lion haulouts, excellent beach-combing in areas with exposure to the west, and archaeological and historical features, including those in Anthony Island Provincial Park.

SOCIOPOLITICAL FEATURES AND COASTAL FACILITIES

Data Collection

The following sources of information on sociopolitical features were used during the course of this study:

- interviews with town managers (Masset and Port Clements) regarding community facilities and services (e.g., water supply, sewage disposal);

- maps reviewed in the B.C. Forest Service office in Queen Charlotte City and in Crown Forest Products offices in Sandspit, and maps from the MacMillan Bloedel offices in Juskatla. (These maps contained information on roads and the boundaries of different types of forest tenures. MacMillan Bloedel also provided detailed descriptions of all of their shoreline land uses including dry-land sorts, booming grounds, barge and equipment ramps, seaplane ramps and wharves);

- Sailing Directions, British Columbia coast published by the Canadian Hydrographic Service (Canadian Hydrographic Service 1983). (This source was very valuable for information on wharves, floats, mooring buoys, and seaplane ramps); and

- a number of Queen Charlotte Island guidebooks. (These sources provided miscellaneous information).

Data Overview

The data base on sociopolitical features is generally adequate, although it could be improved with more information on coastal logging facilities. The information on MacMillan Bloedel's coastal logging facilities within Tree Farm License (TFL) 39 on Graham Island and the northern part of Moresby Island is fairly complete. However, little information was available from other tree farm licensees on the islands.

The extensive coverage of the islands with tree farm licenses is a dominant feature of this data base. Virtually all of Moresby Island and adjacent smaller islands are covered with tree farm licenses.

Regional Overviews of Sociopolitical Features and Coastal Facilities

Region 1: North Coast of Graham Island. Notable sociopolitical features of this region include ecological reserves at Rose Spit, Tow Hill and Lepas Bay; facilities in the communities of Masset and Haida (new and old Masset); and Naikoon Provincial Park which is bounded on the north by North Beach-McIntyre Bay.

Region 2: Masset Inlet and Sound. The logging industry dominates the sociopolitical landscape of the Masset Inlet coast, as MacMillan Bloedel's TFL 39 surrounds most of Masset Sound. Extensive log-handling facilities are located in Juskatla, and in McCLinton, Dinan, Shannon and Ferguson bays.

Region 3: East Coast of Graham Island. Naikoon Provincial Park, which extends from Rose Spit to Tlell, is the most significant sociopolitical feature of the east coast of Graham Island. The communities of Tlell and Lawn Hill are also located along this coast, but have no facilities for boats.

Region 4: West Coast of Graham Island. There are few sociopolitical features on the west coast of Graham Island.

Region 5: Skidegate Inlet. Skidegate Inlet is surrounded by MacMillan Bloedel's TFL 39 and Crown Forest Products TFL 2. The other notable sociopolitical features of Skidegate Inlet are the commmunities of Sandspit, Skidegate Inlet, Skidegate and Queen Charlotte City, and their attendant coastal facilities (e.g., ferry terminals, wharves, and seaplane ramps, etc.).

Region 6: East Coast of Moresby Island. An ecological reserve covering the Rankine and East Copper islands, and ecological reserve proposals for the Windy Bay-Dodge Point, Matheson Inlet and Limestone Island areas are important sociopolitical features of this region. The extensive tree farm licenses (MacMillan Bloedel TFL 39, Crown Forest Products TFL 2 and Western Forest Products TFL 24) and log-handling facilities are the most prominent features of the sociopolitical data base for this region.

Region 7: West Coast of Moresby Island. Important sociopolitical features of this region include ecological reserve proposals for the Botany Inlet and Kootenay Inlet areas, and Tree Farm Licenses 2, 24 and 39 which completely cover this region.

Region 8: South Moresby. Ecological reserves covering the Anthony Islets and the Kerouard Islands are located in this area, as is Anthony Island Provincial Park.

COMMERCIAL RESOURCE HARVESTING

Data Collection

Fish and shell fish are harvested commecially in the Queen Charlotte Islands. The following sources of information were used in preparing the maps and data base on commercial harvesting:

- a Department of Fisheries and Oceans technical report summarizing salmon catch information from the three DFO statistical areas around the Queen Charlotte Islands: areas 1, 2E and 2W (Orman and Sprout 1984);

- a summary of abalone landings from the coastal waters surrounding the Queen Charlotte Islands from 1977 to 1983. (The summary was prepared by K. Bates (1984) from log-book information based on catches from major inlets and inlet systems, to protect the confidentiality of the log-book information); and

- DFO file records of hailed catches from net fisheries in statistical areas 1, 2E and 2W from 1979 to 1984.

Other sources of information were too general for inclusion in the data base, and are reported in the "Data Overview."

Data Overview

Salmon and roe-herring fisheries are the most important commercial fisheries in the Queen Charlotte Islands area in terms of landed value which is also true for the B.C. coast as a whole. Other fisheries of current and recent importance (in terms of landed value) in Queen Charlotte Island coastal waters are directed at crabs, razor clams, abalone, geoducks and halibut. The following facts indicate the economic importance of the invertebrate component of these other fisheries:

- the total annual gross wholesale value of invertebrate harvests averaged for 1981-84 was approximately $1.6 million, which is about 8% of the total invertebrate harvest for British Columbia;

- abalone and crab are the most significant harvests comprising 17% and 74%, respectively, of the value of all invertebrates harvested from the waters surrounding the Queen Charlotte Islands; and

- Queen Charlotte Islands abalone harvests constitute 36% of B.C. abalone harvests; similarly, Queen Charlotte Islands crab harvests constitute 25% of B.C. crab harvests.

The information base on commercial salmon catches by seine and gillnet gear is better than for any other type of gear or target species. This information is derived from "hailed" catches provided by fishermen to fisheries officers during, and immediately after, net fishery openings. It is recorded by management unit, thus providing a geographically disaggregated data base, not available for any other fishery. For specific contingency and coastal

zone planning purposes, the information available on the volumes and locations of catches in other commercial fisheries is incomplete. Thus, information on salmon net fishery catches is the only commercial harvesting data recorded in the data base.

Table 8 summarizes information obtained from the analysis of fishermen's sales slips. This information is only available by DFO statistical area (see Figure 7).

Regional Overviews of Commercial Resource Harvesting

Region 1: North Coast of Graham Island. The Parry Passage-Klashwun Point area is the location of an important seine and gillnet fishery for migrating sockeye and pink salmon stocks. Minor catches of chum, coho and chinook salmon are also made in this fishery. An increasing proportion of the landings from this fishery has been made by seine vessels, at the expense of the gillnet sector. Average landings from this fishery are recorded in the data base.

The north coast of Graham Island is also an important area for the coastal troll fishery targetted on chinook, coho and pink salmon. Landings of pink salmon from the north coast troll fishery have increased substantially in recent years. The troll fleet concentrates particularly in the Parry Passage-Langara Island area.

Other important fisheries in this area include the razor clam fishery on the extensive beaches between Masset (Haida) and Rose Spit, the crab fishery in Naden Harbour, Virago Sound, and McIntyre Bay, the halibut fishery, and abalone fishery in the Parry Passage, Virago Sound area, and dragging for dover sole and pollock in McIntyre Bay (Government of Canada and Province of B.C. 1985).

Region 2: Masset Inlet and Sound. In terms of landed value, the most important fishery in the Masset Inlet and Sound region is the seine fishery

TABLE 8

Average Landings (Metric Tons) of Selected Finfish and Shellfish Species in DFO Statistical Areas 1, 2E and 2W, 1981-1985

Species	Area 1	Area 2E	Area 2W
Prawns	0.08	1.48	0.15
Shrimp	3.10	0.00	0.30
Clams	45.78	0.25	0.00
Abalone	8.35	12.88	1.25
Crabs	233.25	22.08	0.63
Geoducks	0.13	3.55	0.00
Halibut	493.31	1019.59	248.97
Sole (all spp.)	253.38	234.80	66.03
Lingcod	36.90	85.00	25.10
Pacific cod	60.63	563.98	8.23
Sablefish	210.29	190.88	1168.65
Pacific ocean perch	626.98	953.83	904.83
Rockfish (all spp.)	841.75	1414.18	1736.40
Walleye pollock	208.40	28.48	3.18
Roe-on-kelp	0.00	81.55	1.13
Roe herring	0.00	5162.78	1074.38
Food and bait herring	107.83	71.88	0.00

for even-year pink salmon and, to a lesser extent, chum salmon. Until 1984, returns of pink salmon to the Yakoun River had been very poor for a number of years, and the Masset Inlet seine fishery has been drastically curtailed (Orman and Sprout 1984).

The only other fishery of commercial importance in the Masset Inlet and Sound region has been a minor shrimp trawl fishery (Government of Canada and Province of B.C. 1985).

Region 3: East Coast of Graham Island. There are no salmon net fisheries in this region, but salmon catches with troll gear are made off the northeast coast of Graham Island, and off the coast between Sandspit and Tlell. Crabs are also harvested with traps off the northeast coast of Graham Island. Exploratory fishing for geoducks was conducted in this area in 1985. Halibut are caught with longline gear in this area and dogfish are caught with trawls (Government of Canada and Province of B.C. 1985).

Region 4: West Coast of Graham Island. Rennell Sound and Kano Inlet have been the locations for a major seine and much smaller gillnet fishery for passing sockeye and chinook stocks. This fishing has developed over the last 10 years. Management actions in recent years have been designed to minimize catches of chinook salmon in this fishery (Orman and Sprout 1984). Terminal net fisheries for chum salmon have also been held in Athlow Bay and Nesto and Seal Inlets. These fisheries are opportunistic in nature and, therefore, irregular.

Shields Bay, and Seal and Tartu inlets have been the locations of significant roe-herring fisheries in the past, but these areas are less important than roe-herring fishing locations on the east coast of the islands (Government of Canada and Province of B.C. 1985). Trollers targetting on passing chinook and coho salmon stocks operate along the entire coast in this area, and particularly around Marble Island.

Halibut, black cod, Pacific ocean perch and rockfish are harvested with longline, trap and trawl gear in this region. This region is particularly important for the black cod fishery which has developed in recent years.

Region 5: Skidegate Inlet. Skidegate Inlet has been the location of the most important fall net fisheries for chum and coho salmon in the Queen Charlotte Islands. Both east and west ends of the inlet are often opened. There are also minor fisheries for prawns, dover sole and dogfish in Skidegate Inlet.

Region 6: East Coast of Moresby Island. Cumshewa and Selwyn inlets and Darwin Sound have been the locations for fall chum, pink and coho net fisheries. The entire east coast area is an important area for salmon trolling. Juan Perez Sound and Atli and Cumshewa inlets have been extremely important areas for the roe-herring fishery and have provided much of the landings from the Queen Charlotte Islands. The geoduck fishery has developed in recent years in a number of inlets on the east coast of Moresby Island, particularly in Cumshewa Inlet. A lot of abalone have been harvested from the east coast of Moresby Island, specifically from Cumshewa Inlet (Bates 1984). Cumshewa Inlet has been closed for abalone stock rebuilding in recent years. Prawns have been harvested to a limited extent from some of the inlet systems in this area (Dana and Selwyn inlets), and dogfish and Pacific cod are also harvested off the east coast of Moresby Island (Government of Canada and Province of B.C. 1985).

Region 7: West Coast of Moresby Island. Fall seine fisheries in Tasu and Inskip inlets have been directed at chum and coho salmon. The entire west coast of Moresby Island is also a salmon troll fishery area. Inskip Inlet has also been the location of roe-herring fisheries in recent years. Landings of halibut, black cod, Pacific ocean perch and rockfish are also made from this region.

Region 8: South Moresby. Fall net fisheries for chum and coho salmon have been held in Flamingo and Skincuttle inlets and in Juan Perez Sound. Louscoone and Skincuttle inlets and Juan Perez Sound are important areas for the roe-herring fishery. South Moresby has been the most important area in the Queen Charlotte Islands for the abalone fishery, with landings being made from the Kunghit Island area, Houston Stewart Channel, Juan Perez Sound, and Louscoone and Flamingo Inlets. Some of these areas have been closed for varying periods to allow stock rebuilding (Bates 1984). The geoduck fishery has apparently expanded from the northern part of Moresby Island into this area in recent years.

NON-COMMERCIAL RESOURCE HARVESTING

Data Collection

It was recognized during the planning and design of this study that consolidated information on non-commercial use of coastal resources was essentially non-existent. Thus it would be necessary to undertake primary research to acquire information on this topic. The interview-recall method of research was selected, as opposed to creel census research, because of the limited amount of time and money available for the study. Three interviewers chosen by the Council of the Haida Nation were trained in interviewing, data recording and mapping, and data analysis. These interviewers started the interview program by contacting non-native individuals they knew who spent a lot of time fishing, gathering seafoods and hunting. These individuals were asked to suggest other people who made extensive subsistence or sport use of coastal resources. In this way individuals representing about 110 households from Masset, Port Clements, Tlell, Queen Charlotte City and Sandspit were identified and interviewed. The interview sample was not designed to be representative of the population as a whole, as the intent of the research program was not to obtain quantitative estimates of resource use or harvesting effort. The objective was to provide information on the location and extent

of areas used for non-commercial resource harvesting and on the target species. For this reason, the sample was selected specifically to obtain as much information as possible on resource harvesting locations and target species.

Interviewees were asked to list the species that they harvested for their own use or for trade with friends, and were prompted with a list of 33 species. They were then asked to mark on 1:50,000 NTS maps the areas where they harvested each species. For each species, they were asked to provide information on the time of year of the harvest, the harvest method, the number of times per year an area was used, the approximate tidal height of harvesting activities (e.g., high intertidal or mid-intertidal), and whether the harvest activities were current (1980-present), recent historical (1960-1980), or early historical (pre-1960).

The interview program provided a rich data set. The interviewers spent about three weeks full-time compiling the data from the interview records. This involved cross-referencing the interview records with approximately 2,300 species-location data records.

Only non-native people were interviewed as part of the research program on non-commercial resource use. An interview program to obtain information on non-commercial resource use by Haida people is needed to make the data base truly comprehensive. However, for cultural and political reasons this information is of great importance to Haida people, and it is unlikely that Haida people will agree to contribute this information until mechanisms for the participation of the aboriginal owners in resource management are developed through a land claims negotiation process or unless the ESRF would accept information derived from information on Haida subsistence resource use, rather than the resource use information itself.

Data Overview

The interview program on non-commercial use of coastal zone resources provided a rich data base. The data demonstrated that non-Haida residents of

the Queen Charlotte Island make widespread non-commercial use of the islands' coastal resources. Many regions of the islands, particularly the east and north coasts, are used extensively for non-commercial resource harvesting. In some cases these areas include two or three "zones" extending out from the coast and corresponding to different depths. Only two of the 44 1:50,000 NTS map sheets for the Queen Charlotte Islands are without indications of non-commercial, consumptive resource use by residents of the 110 households interviewed.

The interview program yielded a total of approximately 2,300 data records. Each data record corresponds to a harvesting area for a particular species. As such, the non-commercial resource-use data base is far larger than any of the other data bases compiled in this study. The 2,300 data records correspond to an average of about 52 data records per map sheet.

Despite its size, this data base has one glaring inadequacy: the lack of any information on the non-commercial use of coastal zone resources by Haida people. Haida people were not included in the interview program, and it is expected that interviewing Haida people would generate many new data records or species-location combinations.

Individuals in the interview program reported harvesting 53 different types of food from the coastal zone. Table 9 presents a list of these food types. The most intensively used areas, and the areas with the highest degree of coastal coverage, are close to the major communities of Masset, Haida, Port Clements, and Queen Charlotte City-Skidegate-Sandspit. In the following regional descriptions, there are few comments on unique species arrays from particular areas, as most species are harvested in all eight regions.

Residents participated in the interview program on the understanding that information they contributed would be confidential. Consequently, this data type is protected by a password to restrict access to the data to authorized users.

TABLE 9

Food Types Harvested Non-Commercially
in the Queen Charlotte Islands[1]

FISH	INVERTEBRATES
Pink salmon	Abalone*
Sockeye salmon	Octopus
Steelhead	Squid
Chinook salmon*	Prawns
Chum salmon	Shrimp
Coho salmon*	Chitons
Dolly varden	Sea cucumber
Cutthroat trout	Sea urchin
Halibut	Gooseneck barnacle
Ling cod*	Spider crab
Red snapper*	Rock crab
Rockfish	King crab
Cabezon	Dungeness crab*
Sole	Box crab
Kelp greenling	Horse clams
Blackcod	Littleneck clams
Herring	Butter clams*
Grey cod	Softshell clams
Rock cod*	Razor clams*
Smelt	Cockles
Flounder	Geoduck
Skate	California mussel
	Blue mussel*
	Rock scallop
BIRDS	Scallop
Brant	
Geese	PLANTS
Ducks	Glasswort
	Sea lettuce
	Kelp

* indicates the species harvested in a very large number of different areas.
[1] Formal species names are not used in this list because they were not used in the interview program. Some types possibly refer to a number of different species (e.g. sea urchin, sole, rockfish).

Regional Overviews of Non-Commercial Resource Harvesting

Region 1: North Coast of Graham Island. The most intensively used areas of this region are the Masset Harbour-Masset Sound area, the Wiah Point area, Naden Harbour and Virago Sound, Langara Island, the McIntyre Bay area and Tow Hill, and reefs offshore of the most westerly part of this region. The Masset Harbour-Tow Hill and Wiah Point areas are subject to particularly intense non-commercial resource harvesting, presumably because of their proximity to the community of Masset.

Region 2: Masset Sound and Inlet. Masset Sound itself, Juskatla Inlet (particularly the narrows), and the Yakoun Bay-Kumdis Island area are favourite areas for sportfishermen and hunters. The data base indicates that non-commercial resource users are particularly attracted to the area for opportunities to hunt waterfowl, to fish for a wide variety of salmonids (chinook, coho, pink, chum and sockeye salmon, steelhead, cutthroat trout and dolly varden), and to harvest prawns, shrimps and crabs.

Region 3: East Coast of Graham Island. According to the results of the interview program, few people use the northern part of this region (from Cape Ball north) for non-commercial resource harvesting. The area from Tlell south, and including Tlell, is subject to more intensive use. Apart from the salmonid sportfishing opportunities on and near the Tlell River, it appears that this area is a particularly good area for harvesting octopus.

Region 4: West Coast of Graham Island. With the exception of the Shields Bay area (which is accessible by road from Juskatla and Queen Charlotte City), there is relatively little non-commercial coastal resource use in this region, compared to other regions.

Fishing effort in this region (except for Shields Bay) is directed at chinook salmon, rock cod, ling cod and halibut. Shields Bay is, according to the results of the interview program, subject to intensive non-commercial harvesting of a wide variety of species.

Region 5: Skidegate Inlet and Channel. This region appears to be the area of the Queen Charlotte Islands most intensively used for non-commercial resource harvesting. The entire region is subject to intensive use from Skidegate Inlet to Cartwright Sound. This intensity of use is probably a result of the proximity and accessibility of the area to Queen Charlotte City, Skidegate and Sandspit and the sheltered route Skidegate Channel provides to the west coast.

Region 6: East Coast of Moresby Island. This region is also one of extensive non-commercial resource harvesting. Sport and subsistence fishing, collecting of shellfish, and hunting are concentrated in the Bischof Islands-Darwin Sound, Skedans-Selwyn Inlet, Tanu, Carmichael Passage-Gillatt Arm, Cumshewa Inlet and Hot Springs Island-Windy Bay areas. Cumshewa Inlet, which is readily accessible to Sandspit, is subject to particularly intense use.

Region 7: West Coast of Moresby Island. Since the closing down of the mining operation at Tasu, there has apparently been little non-commercial resource harvesting in this region, with the exception of the Moore Channel area. Many hunters appear to be attracted to the ends of inlets off Moore Channel to hunt for waterfowl.

Region 8: South Moresby. Given the distance of this region from major communities in the Queen Charlotte Islands, the extent of non-commercial resource use in this area by islands residents is noteworthy. This indicates that residents of the Queen Charlotte Islands, as well as tourists, make extensive use of the South Moresby area for non-commercial resource harvesting (and presumably for sight-seeing).

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APPENDICES

APPENDIX A

OBTAINING INFORMATION AND STUDY PRODUCTS

REPORT

Additional copies of this report can be purchased from:

Pallister Resources Management Ltd.
105, 4116 - 6th Avenue S.E.
Calgary, Alberta
T2C 2B3

Telephone: (403) 236-2344
Telex: 03-821172

MAINFRAME COMPUTER PRODUCTS

Information on how to obtain printed listings of non-graphic data and maps, and magnetic tapes with selected graphic and non-graphic information can be obtained from:

Director
Environmental Studies Research Funds
355 River Road
Ottawa, Ontario
K1A 0E4

Telephone: (613) 993-3760
Telex: 053-4366

Information on non-commercial harvesting of coastal zone resources, archaeological sites and areas of recreational significance is restricted and sensitive. See below for further information on these data types.

MICROCOMPUTER SOFTWARE AND DATA

The software and data base are designed and configured to run on IBM PC or compatible computers with two double-sided disk drives (360K), at least 256 K of RAM, and a colour graphics card. (Hard disk drives can also be used for storage of the data.) Maps can be printed on graphics-capable printers.

Copies of the software (PCINFORM) required to use the data base and digital maps, and the actual data diskettes can be purchased from:

MacLaren Plansearch Corp.
1100, 1140 W. Pender Street
Vancouver, B.C.
V6E 4G1

Telephone: (604) 684-3216
Telex: 04-55112

The software can be provided on one diskette; 91 diskettes are required for the entire data base. A PCINFORM User's Manual is also available from the above address.

The purchase price incorporates copying (labour) costs, as well as diskette and mailing costs.

RESTRICTED INFORMATION

Information on non-commercial resource harvesting, archaeological sites and recreational sites is restricted and special arrangements must be made to access the data.

Information on non-commercial harvesting of coastal resources cannot be provided to anyone without **prior, written approval** from the Council of the Haida Nation.

People wishing to obtain this type of information should apply in writing to:

Offshore Committee
Council of the Haida Nation
P.O. Box 98
Queen Charlotte City, B.C.
V0T 1S0

Telephone: (604)559-4468 (Queen Charlotte City)
(604) 626-5252 (Masset)

The following information should be provided with written requests:

(1) The name and mandate of the individual or group applying for access to the information;

(2) The purpose for which the information is required;

(3) A detailed description of the nature of the information required. This description will be used to determine if summaries of the restricted information will satisfy the prospective user's needs;

(4) In what form the prospective user would like to obtain the information (copies of maps, inspection of information on video screens, copies of diskettes); and

(5) How the prospective user would propose to protect the restricted nature of the information.

Information on archaeological sites is also restricted. Persons interested in obtaining this information should apply to:

Resource Management Division
Heritage Conservation Branch
333 Quebec Street
Victoria, B.C.
V8V 1X4

Telephone: (604) 387-1011

Some information on areas of recreational significance is sensitive. Persons interested in obtaining access to the sensitive information should contact:

ESRF Director
355 River Road
Ottawa, Ontario
K1A 0E4

Telephone: (613) 993-3760

APPENDIX B

FIVE TYPES OF DATA SHEETS

BIOLOGICAL DATA SHEET

DATA TYPE

_____ a) COASTAL ZONE PLANTS
_____ b) SHELLFISH AND OTHER INVERTEBRATES
_____ c) FISH
_____ d) BIRDS AND MAMMALS

CODED BY _____ (15 characters)

RECORD NUMBER _____

COMMON NAME _____
(30 characters)

TRANSVERSE LOCATION (tick 2 locations to show range of distribution if appropriate; 3 locations for discontinuous distribution)

_____ a) BACKSHORE
_____ b) SUPRA INTERTIDAL
_____ c) HIGH INTERTIDAL
_____ d) MID INTERTIDAL
_____ e) LOW INTERTIDAL
_____ f) SUBTIDAL
_____ g) SUBTIDAL, 0- -10m
_____ h) SUBTIDAL, -10m OR DEEPER

SEASONAL OCCURRENCE AND ACTIVITY (tick all boxes that apply; enter appropriate letter for LOCAL ABUNDANCE, leave blank if not applicable)

	J	F	M	A	M	J	J	A	S	O	N	D
BREEDING (spawning, nesting incubating, whelping, calving)												
YOUNG (seedlings, spat settlement, smolting, fledging)												
REARING												
OVERWINTERING/ NON BREEDING												
MIGRATING												
RESIDENT												
LOCAL ABUNDANCE (relative) a) rare b) endangered c) threatened d) common e) abundant f) unknown												

NUMBER _____ (units to be specified, e.g. No/km^2, No. or pairs, etc.).

REFERENCE YEARS _____ to _____

_____ a) PERSONAL INTERVIEW
_____ b) GOVERNMENT REPORT
_____ c) UNPUBLISHED MANUSCRIPT
_____ d) SCIENTIFIC PUBLICATION
_____ e) RAW DATA/DATA RECORD
_____ f) TECHNICAL REPORT
_____ g) MAPS
_____ h) BOOK
_____ i) OTHER

DATA STATUS (tick all that apply)

_____ a) OBSERVATIONAL/EMPIRICAL
_____ b) EXTRAPOLATION/INFERENCE
_____ c) ANECDOTAL
_____ d) OTHER

DATA COLLECTION METHOD (tick all that apply)

_____ a) AERIAL SURVEY
_____ b) BOAT SURVEY
_____ c) GROUND SURVEY
_____ d) DIVING SURVEY
_____ e) SAMPLES COLLECTED
_____ f) GILLNET SAMPLE
_____ g) SEINE SAMPLE
_____ h) TRAP SAMPLE
_____ i) DREDGE SAMPLE
_____ j) QUADRAT SAMPLE
_____ k) TRAWL SAMPLE
_____ l) OTHER

DATA SOURCES

Author. Date. Title/Interview/Report/Data

Publication details, etc. (as appropriate)

ARCHAEOLOGICAL SITES DATA SHEET

CODED BY _____ (15 characters)

RECORD NUMBER _____

SITE TYPE

_____ a) MIDDEN
_____ b) CULTURALLY MODIFIED TREE
_____ c) PETROGLYPH
_____ d) PETROFORM
_____ e) PICTOGRAPH
_____ f) FISH TRAP OR WEIRS
_____ g) BURIAL SITE
_____ h) GENERAL ACTIVITY - ARTIFACTS
_____ i) ISOLATED FIND
_____ j) CULTURAL DEPRESSION
_____ k) CANOE REMAINS
_____ l) CANOE RUNS
_____ m) FORTIFICATION SITES
_____ n) ROCK FORMATIONS
_____ o) OTHER

TRAVERSE LOCATION

_____ a) BACKSHORE
_____ b) SUPRA TIDAL
_____ c) INTERTIDAL
_____ d) SUBTIDAL

CONTROLLED EXCAVATION

_____ a) YES
_____ b) NO

MAXIMUM DEPTH OF CULTURAL HORIZONS _____ Metres

AREAL EXTENT _____ m^2

SITE CONDITION _____ % DISTURBED

ELEVATION WITH RESPECT TO MLLW _____ metres

ESTIMATED AGES

_____ Max. yrs. B.P.
_____ Min. yrs. B.P.

NUMBER OF DISTINCT CULTURAL HORIZONS _____

SITE DESCRIPTION _____
(60 characters)

DATA FORM

_____ a) PERSONAL INTERVIEW
_____ b) GOVERNMENT REPORT
_____ c) UNPUBLISHED MANUSCRIPT
_____ d) SCIENTIFIC PUBLICATION
_____ e) RAW DATA/DATA RECORD
_____ f) TECHNICAL REPORT
_____ g) MAPS
_____ h) BOOK
_____ i) OTHER

DATA STATUS

_____ a) OBSERVATIONAL/EMPIRICAL
_____ b) INFERENCE/EXTRAPOLATION
_____ c) ANECDOTAL
_____ d) OTHER

DATA SOURCES

Author. Date. Title/Interview/Report/Data

Publication details, etc. (as appropriate)

SIGNIFICANT SITES DATA SHEET

DATA TYPE

_____ a) HISTORICAL AND CULTURAL SITES
_____ b) AESTHETIC, RECREATIONAL AND SCIENTIFIC SITES

CODED BY _____ (15 characters)

RECORD NUMBER _____

SITE TYPE

_____ a) AESTHETIC
_____ b) RECREATIONAL
_____ c) SCIENTIFIC
_____ d) HISTORICAL
_____ e) CULTURAL-VILLAGE SITE
_____ f) CULTURAL-FISHING STATION
_____ g) CULTURAL-OTHER

NAME OR DESCRIPTION _____
(80 characters)

SIGNIFICANT DATE _____

DETAILED DESCRIPTION _____
(120 characters)

DATA FORM

_____ a) PERSONAL INTERVIEW
_____ b) GOVERNMENT REPORT
_____ c) UNPUBLISHED MANUSCRIPT
_____ d) SCIENTIFIC PUBLICATION
_____ e) RAW DATA/DATA RECORD
_____ f) TECHNICAL REPORT
_____ g) MAPS
_____ h) BOOK
_____ i) OTHER

DATA STATUS

_____ a) OBSERVATIONAL/EMPIRICAL
_____ b) INFERENCE/EXTRAPOLATION
_____ c) ANECDOTAL
_____ d) OTHER

DATA SOURCE

Author. Date. Title/Interview/Report Data

Publication details, etc. (as appropriate)

SOCIO-POLITICAL FEATURES AND COASTAL FACILITIES DATA SHEET

CODED BY _____ (15 characters)

RECORD NUMBER _____

FEATURE OR FACILITY

_____ a) VILLAGE/TOWN
_____ b) NATIONAL PARK
_____ c) PROVINCIAL PARK
_____ d) ECOLOGICAL RESERVE
_____ e) TRIBAL PARK
_____ f) INDIAN RESERVE
_____ g) TFL
_____ h) DFO MANAGEMENT UNIT
_____ i) WHARF
_____ j) MARINA/BOAT YARD
_____ k) FERRY TERMINAL
_____ l) FLOAT PLANE FACILITY
_____ m) BOAT RAMP
_____ n) LIGHTHOUSE
_____ o) GAS STATION
_____ p) LOGGING FACILITIES
_____ q) MINING FACILITIES
_____ r) COASTAL ROAD
_____ s) CABLE LOCATION
_____ t) PIPELINE LOCATION
_____ u) SEWAGE OUTFALL
_____ v) WATER INTAKE
_____ w) COAST GUARD FACILITY
_____ x) MILITARY BASE
_____ y) WILDLIFE RESERVE
_____ z) OTHER

NAME OF FEATURE OR FACILITY _____

(60 characters)

STATUS

_____ a) EXISTING
_____ b) PROPOSED

TRANSVERSE LOCATION

_____ a) BACKSHORE
_____ b) INTERTIDAL
_____ c) SUBTIDAL

FACILITY OWNERSHIP

_____ a) FEDERAL GOVERNMENT
_____ b) PROVINCIAL GOVERNMENT
_____ c) MUNICIPALITY
_____ d) INDIAN BAND
_____ e) CROWN CORPORATION
_____ f) PRIVATE CITIZEN
_____ g) PRIVATE COMPANY
_____ h) OTHER

SEASONAL ACTIVITY (tick all months that apply)

J F M A M J J A S O N D

DESCRIPTION OF FACILITY OR FEATURE _____

(40 characters)

DATA FORM

_____ a) PERSONAL INTERVIEW
_____ b) GOVERNMENT REPORT
_____ c) UNPUBLISHED MANUSCRIPT
_____ d) SCIENTIFIC PUBLICATION
_____ e) RAW DATA/DATA REPORD
_____ f) TECHNICAL REPORT
_____ g) MAPS
_____ h) BOOK
_____ i) OTHER

DATA SOURCE

Author. Date. Title/Interview/Report/Data

Publication details, etc. (as appropriate)

RESOURCE HARVESTING DATA SHEET

DATA TYPE

_____ a) COMMERCIAL HARVESTING
_____ b) NON-COMMERCIAL HARVESTING

CODED BY _____ (15 characters)

RECORD NUMBER _____

COMMON NAME OF RESOURCES _____
(30 characters)

USER GROUP (leave blank if unknown or both)

_____ a) HAIDA
_____ b) NON-HAIDA

TRANSVERSE LOCATION (tick 2 locations to show range of distribution, if appropriate; tick 3 if discontinuous)

_____ a) BACKSHORE
_____ b) SUPRA TIDAL
_____ c) HIGH INTERTIDAL
_____ d) MID INTERTIDAL
_____ e) LOW INTERTIDAL
_____ f) SUBTIDAL
_____ g) SUBTIDAL, 0 to -10m
_____ h) SUBTIDAL, -10m OR DEEPER

HARVEST SEASON (tick all months that apply)

J F M A M J J A S O N D

PERIOD

_____ a) CURRENT (1980-present)
_____ b) RECENT HISTORICAL (1960-1980)
_____ c) HISTORICAL (pre-1960)

HARVEST METHOD (tick all that apply)

_____ a) INTERTIDAL COLLECTION
_____ b) DIGGING
_____ c) SUBTIDAL (DIVING) COLLECTION
_____ d) SPEARFISHING
_____ e) SPEARING
_____ f) HOOKED POLE
_____ g) TROLL
_____ h) HANDLINE
_____ i) JIGGING
_____ j) LONGLINE
_____ k) MIDWATER TRAWL
_____ l) BOTTOM TRAWL OR DRAG
_____ m) GILLNET
_____ n) PURSE SEINE
_____ o) DREDGE
_____ p) TRAP
_____ q) SHOOTING
_____ r) IMPOUNDMENT
_____ s) MARICULTURE
_____ t) CAGE MARICULTURE
_____ u) PEN MARICULTURE
_____ v) LINE MARICULTURE
_____ w) NEAR-BOTTOM MARICULTURE
_____ x) BOTTOM MARICULTURE
_____ y) OTHER

ESTIMATED EFFORT (fill in whatever applies - leave blank if unknown)

_____ PERSON-DAYS
_____ VESSEL-DAYS
_____ DEVICE-DAYS

DEVICE TYPE _____

(20 characters)

ESTIMATED QUANTITY (leave blank if unknown)

_____ NUMBER/YEAR
_____ KILOGRAMS/YEAR

LANDED VALUE (commercial only) $ _____

REFERENCE YEARS 19 ____ to 19 ____

DATA FORM

_____ a) PERSONAL INTERVIEW
_____ b) GOVERNMENT REPORT
_____ c) UNPUBLISHED MANUSCRIPT
_____ d) SCIENTIFIC PUBLICATION
_____ e) RAW DATA/DATA RECORD
_____ f) TECHNICAL REPORT
_____ g) MAPS
_____ h) BOOK
_____ i) OTHER

DATA STATUS

_____ a) OBSERVATIONAL/EMPIRICAL
_____ b) EXTRAPOLATION/INFERENCE
_____ c) ANECDOTAL
_____ d) OTHER

DATA SOURCES

Author. Date. Title/Interview/Report/Data

Publication details, etc. (as appropriate)

(list interviewees or numbers of interviews if very large)

APPENDIX C

SPECIES LIST OF ORGANISMS MENTIONED IN TEXT

APPENDIX C

SPECIES LIST OF ORGANISMS MENTIONED IN TEXT

Common Name	Scientific Name
PLANTS	
Glasswort	
Kelp	*Macrocystis integrifolia*
	Nereocystis leutkeana
Sea lettuce	*Ulva lactuca*
INVERTEBRATES	
abalone	*Haliotis kamtschatkana*
barnacle, gooseneck	*Pollicipes polymerus*
chiton	*Katharina tunicata*
clam, butter	*Saxidomus giganteus*
clam, horse	*Tresus capax*
clam, littleneck	*Protothaca staminea*
clam, razor	*Siliqua patula*
clam, softshell	*Mya arenaria*
cockle	*Clinocardium nuttalli*
crab, box	*Lopholithodes mandtii*
crab, Dungeness	*Cancer magister*
crab, king	*Paralithodes camtschatica*
crab, rock	*Cancer productus*
crab, spider	-
geoduck	*Panopea generosa*
mussel, blue	*Mytilus edulis*
mussel, California	*Mytilus californianus*
octopus	*Octopus dofleini*

Common Name	Scientific Name
INVERTEBRATES (cont'd)	
prawn	Pandalus platyceros
scallop	Pecten caurinus
scallop, rock	Hinnites giganteus
sea cucumber	Parastichopus californicus
sea urchin, red	Stronglyocentrotus franciscanus
shrimp, sidestripe	Pandalus dispar
squid	Loligo opalescens
FISH	
blackcod (=sablefish)	Anoplopoma fimbria
cabezon	Scorpaenichthys marmoratus
cod, grey	Gadus macrocephalus
cod, ling	Ophioden elongatus
cod, Pacific	Gadus macrocephalus
cod, rock	-
dogfish	Squalus acanthias
Dolly varden	Salvelinus malma
flounder	Platichthys stellatus
halibut	Hippoglossus stendepis
herring, Pacific	Clupea harengus pallasi
perch, Pacific Ocean	Sebastes alutus
pollock, walleye	Theragra chalcogramma
rockfish	Sebastes spp.
sablefish (=blackcod)	Anoplopoma fimbria
salmon, chinook	Oncorhynchus tshawytscha
salmon, chum	Oncorhynchus keta
salmon, coho	Oncorhynchus kisutch
salmon, pink	Oncorhynchus gorbuscha
salmon, sockeye	Oncorhynchus nerka
skate	Raja spp.

Common Name	Scientific Name
FISH (cont'd)	
snapper, red	Sebastes ruberrimus
sole	Inopsetta ischyra
sole, butter	Isopsetta isolepis
sole, English	Parophrys vetulus
sole, rock	Lepidopsetta bilineata
trout, cutthroat	Salmo clarkii
BIRDS	
auklet, Cassin's	Ptychoramphus aleuticus
auklet, rhinoceros	Cerorhina monocerata
cormorant, pelagic	Phalacrocorax pelagicus
crane, sandhill	Grus canadensis
dowitcher, long-billed	Limnodromus scolopaceus
dowitcher, short-billed	Limnodromus griseus
dunlin	Calidris alpina
eagle, bald	Haliaeetus leucocephalus
falcon, peregrine	Falco peregrinus
guillemot, pigeon	Cepphus colomba
gull, glaucous-winged	Larus glaucescens
murre, common	Uria aalge
murrelet, ancient	Synthilboramphus antiquus
murrelet, marbled	Brachyramphus marmoratus
oystercatcher, black	Haematopus bachmani
phalaropes	-
plover, semipalmated	Charadrius semipalmatus
puffin, horned	Fratercula corniculata
puffin, tufted	Lunda cirrhata
sanderling	Calidris alba
sandpiper, least	Calidris minutilla

Common Name	Scientific Name
BIRDS (cont'd)	
storm-petrel, fork-tailed	Oceanodroma furcata
storm-petrel, Leach's	Oceanodroma leucorhoa
turnstone, black	Arenaria melanocephala
yellowlegs, greater	Tringa melanoleuca
yellowlegs, lesser	Tringa flavipes
MAMMALS	
otter, river	Lutra canadensis
porpoise, Dall	Phocoenoides dalli
seal, harbour	Phoca vitulina
sealion, Steller	Eumetopias jubatus
whale, grey	Eschrichtius gibbosus

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